

Comparison between 23 – Gauge and 25 – Gauge Pars Plana Vitrectomy for Posterior Segment Disease

Huma Kayani, Aamir Ahmed, Kashif Jahangir, Hizb-ur-Rehman, Khurram Chauhan

Pak J Ophthalmol 2013, Vol. 29 No. 1

.....
See end of article for
authors affiliations

.....
Correspondence to:
Huma Kayani
9-Q Gulberg II
Lahore

Purpose: To compare the safety, efficacy and complications (intra and post-operative) of 25 and 23 – gauge transconjunctival suture less vitrectomy.

Material and Methods: It was a single centre, prospective, interventional case series. Fifty eight eyes underwent pars plana vitrectomy using one of the two surgical procedures in Ophthalmology department of Sir Ganga Ram Hospital, Lahore from July 2010 to January 2012. 24 eyes were operated using 25 – gauge and 34 eyes with 23-gauge surgical instruments and technique. In 25 – gauge series, majority of the patients (22 cases, 91.7%) had vitreous hemorrhage as complication of proliferative diabetic retinopathy and venous occlusion complicating into vitreous hemorrhage in remaining 2 cases (8.3%). Vitreous hemorrhage with epiretinal membranes overlying macula (6 cases, 25%) and vitreous hemorrhage alone (18 cases, 75%). 23 gauge series included a greater variety of vitreo-retinal pathologies like vitreous hemorrhage (22 cases) due to proliferative diabetic retinopathy, with epiretinal membranes (10 cases, 29.4%) or without (12 cases, 35.3%) epiretinal membranes, rhegmatogenous retinal detachment (12 cases, 35.5%), out of which superior RD was seen in 10 cases and total RD in 2 cases. In 25 – gauge series, internal tamponade was not required while in 23- gauge series, silicone oil (1000cst) for internal tamponade was used in 18 eyes (52.9%).

Results: In 25-gauge series, most of the procedure was possible. However, the 25 – gauge instruments are quite delicate, narrow gauge and fragile. Bending of the fiber optic light frequently occurred during procedure. The thin epiretinal membranes were easily peeled off from macular area but the stiffer membranes could not be lifted or cut easily with delicate 25 – gauge curved scissors. Instead, vitreous cutter was used to lift and peel the membranes. The fragility of instruments hindered ocular rotation making peripheral vitreous shaving difficult and so required indentation. In 23 – gauge series, the instruments are relatively stiffer making it possible to complete the procedure with ease with including silicone oil fill. Most common complication seen in 25 – gauge series was transient vitreous hemorrhage (6 eyes, 25%) while in 23-gauge series, transient low IOP (14 eyes, 41.2%), transient recurrent vitreous hemorrhage (4 eyes, 11.8%) and scanty leakage of silicone oil (6 eyes, 11.7%) was seen. No wound suturing was required in either series. Visual acuity improved in both groups in postoperative follow-ups.

Conclusion: Both 25-gauge and 23 – gauge vitrectomies are minimally invasive and safe surgical techniques. 23 – gauge offers benefits of stiffer instruments and suitable for larger number of vitreo-retinal pathologies while 25 – gauge instruments are delicate and need careful handling. However, simpler vitreo-retinal pathologies are better suited to 25 – gauge procedure.

The recent evolution in pars plana vitrectomy is the minimal invasive surgery using small gauge instruments. Compared to the traditional 20 – gauge vitrectomy system, both the 23 – gauge and 25 – gauge system makes small, self – sealing suture less transconjunctival pars plana sclerotomies which minimize surgical trauma to conjunctiva and sclera and allows faster recovery.¹

Several authors have reported the successful anatomic and visual outcomes with individual techniques in different vitreo-retinal disorders.^{2,3}

The purpose of this study is to compare the operative and post-operative safety and efficacy of the 23 and 25 – gauge systems.

MATERIAL AND METHODS

We studied two consecutive case series that underwent suture less vitrectomy from July 2010 through January 2012 in department of Ophthalmology, Sir Ganga Ram Hospital, Lahore. All surgeries were carried out by a single surgeon in a single centre. A total of fifty eight cases were enrolled in the study. Data collected included patients age, gender, pathology, examination and indication for surgery. Twenty four eyes were prepared for 25 – gauge and thirty four eyes for 23 – gauge vitrectomy procedure. The indications for 25 – gauge vitrectomy predominantly included diabetic vitreous hemorrhage (18 cases, 75%) and vitreous hemorrhage with epiretinal membranes involving macula (6 cases, 25%), in total 22 eyes (91.7%) while venous occlusion complicating into vitreous hemorrhage was the causative factor in 2 cases (8.3%). The indications for 23-gauge vitrectomy included diabetic vitreous hemorrhage in 12 cases (35.3%), vitreous hemorrhage with ERM in 10 cases (29.4%), rhegmatogenous retinal detachment in 12 cases (35.5%). Out of these 12 cases, superior RD was diagnosed in 10 eyes and total RD in 2 eyes.

In both series, vitreo-retinal disease requiring external and internal tamponade were excluded from this study.

Informed consent from the ethical committee was obtained. Alcon Accurus vitreo-retinal system was used for both procedures.

In the 25 – gauge transconjunctival suture less vitrectomy series, 18 cases were operated under peribulbar local anesthesia while 6 cases under general anesthesia. 25 – gauge surgical technique consisted of angled transconjunctivo-scleral insertion of 25 – gauge

trocars mounted polyamide cannula 3.5 – 4 mm from limbus in inferotemporal, superotemporal and superonasal quadrants, each measuring 0.5 mm. Trocars were pulled out leaving self-retaining cannula in place. The infusion line was secured into inferotemporal port. 5 – gauge instruments used were 1500c.p.m pneumatic cutter, fiberoptic light, membrane pick, soft tip back flush needle, curved microscissors and endodiathermy probe. Photocoagulation was done in all cases. PPV alone was done in 18 eyes (75%) while PPV plus ERM peeling was done in 6 eyes (25%). Triamcinalone was injected to visualize and assist in membrane peeling. On completion of surgery, the cannulas were pulled out one by one with inferotemporal being the last one out. The conjunctiva above the sclerotomy was slightly displaced to compensate for entry sites. Wound was observed for any leakage and a mixture of antibiotic and steroid was injected in inferior sub-conjunctival space.

In the 23 – gauge series, 22 cases (64.7%) were operated using peribulbar anesthesia while 12 cases (35.5%) under general anesthesia. Surgical technique consisted of transconjunctival one step angled incision. 23-gauge cannula mounted trocars were used for creating three 0.75 mm (each) incisions in inferotemporal, superotemporal and superonasal quadrant. Rest of the technique and instruments used was identical to 25 – gauge. Of 34 cases, PPV alone was done in 12 cases, PPV plus ERM peeling in 4 cases, PPV plus silicone oil tamponade in 14 cases and finally PPV, ERM peeling and silicone oil tamponade in 4 cases. intravitreal triamcinalone was injected to assist in membrane peeling. Silicone oil (1000 cst) tamponade was used in 18 eyes (52.9%). On completion of surgery, cannulas were pulled out and wound site massaged with cotton tip. Wound site was observed for leakage and sub-conjunctival injection of antibiotic and steroid was given.

Patients in both series were examined on first day, first week, one month and finally three month post-op for wound leakage, visual acuity, intraocular pressure, anterior and posterior segment examination.

RESULTS

In 25 – gauge series, 24 cases were operated. Out of these, 16 (66.7%) were males and 8 (33.3%) females. Age ranged between 30-60 years. Pre-operative visual acuity (using Snellen's chart) ranged between hand movements to 6/36. Six eyes (25%) had hand movement, fourteen eyes (58.3%) had counting

fingers, two eyes (8.3%) had 6/60 and remaining two eyes (8.3%) recorded visual acuity of 6/36.

Slit-lamp examination revealed clear lens in 8 eyes (33.3%), early lens changes in 12 eyes (50%) and pseudophakia in 4 eyes (16.7%). Intraocular pressure was within normal range in all cases. Posterior segment examination revealed vitreous hemorrhage alone in 18 eyes and vitreous hemorrhage with epiretinal membranes in 6 eyes. Diabetic retinopathy (22 eyes) and venous occlusion (2 eyes) were responsible for the vitreous hemorrhage (Table 1).

All three ports were easily made with little or no pressure on entry. The infusion cannula was long, flexible and had to be secured to avoid accidental lens touch. The 25-gauge instruments were easily used during procedure. Due to narrow, delicate instruments, bending of fiberoptic light occurred during surgery (Fig. 1). Extra care was taken to avoid breakage of instruments. Peripheral vitreous shaving was incomplete due to fragile instruments (cutter and fiberoptic light) which made rotation of eyeball difficult and external indentation was required to complete vitreous shaving. Thin epiretinal membranes were easily cut while stiff membranes could not be cut with curved 25-gauge scissors. Cutter was used to lift, peel and cut these membranes.

In 23-gauge series, of 34 cases, 28 (82.4%) were males and 6 (17.6%) were females. Age ranged between 18 to 76 years. Pre-operative visual acuity ranged between hand movements to counting fingers. Slit-lamp examination revealed clear lens in 21 eyes (61.8%), early lens changes in 6 eyes (17.6%) and pseudophakia in 7 eyes (20.6%). Intraocular pressure was within normal range in all cases. Posterior segment examination showed vitreous hemorrhage alone in 12 eyes, vitreous hemorrhage plus epiretinal membranes in 10 eyes, superior rhegmatogenous retinal detachment in 10 eyes and total RD in 2 eyes (Table 1 or 2).

The three transconjunctivo-scleral ports made with trocar mounted cannula were angled and required some pressure on insertion into the eyeball, unlike 25 – gauge entry which required little or no pressure on insertion. Cannulas were self-retaining. The 23 – gauge instruments were rigid and handling these instruments during vitrectomy was much easier than 25-gauge instruments. No bending or breakage of instruments occurred. Peeling/ cutting of epiretinal membranes were easily done with 23-gauge pick, end-gripping forceps and scissors. The rotation of eye with

23-g cutter and fiberoptic light made peripheral vitreous shaving quite easy and no indentation was needed. Silicone oil (1000 cst) was injected for internal tamponade in eighteen cases (41.2%). 6 eyes (17.6%) showed scanty leakage of silicone oil from one of the ports on completion of vitrectomy. No sutures were applied as leakage was minute and pressure was well controlled.

Table 1: Pre-operative features

	25-Gauge PPV n (%)	23-Gauge PPV n (%)
No. of Eyes	24	34
Male	16 (66.7)	28 (82.4)
Female	8 (33.3)	6 (17.6)
Age Range	30-60 years	18-76 years
Vitreous Hemorrhage	18 (75)	12 (35.3)
VH plus ERM	6 (25)	10 (29.4)
Superior RD	---	10 (29.4)
Total RD	---	2 (5.9)

ERM=epi-retinal membrane



Fig. 1: Bending of fiberoptic light

Day 1 follow-up

In both series, minor sub-conjunctival hemorrhage was seen overlying one of the sclerotomy. In 25 – gauge, 4 eyes (16.7%) and in 23 – gauge series, 8 eyes (23.5%) showed hemorrhage. The bleeding came from

Table 2: Post-operative features

		1 st day		1 st week		1/3 months	
		25-gauge (n-24) n (%)	23-gauge (n-34) n (%)	25-gauge (n-24) n (%)	23-gauge (n-34) n (%)	25-gauge (n-24) n (%)	23-gauge (n-34) n (%)
Sub-conjunctival hemorrhage		4(16.6)	8(23.5)	Cleared	Cleared	Nil	Nil
Silicon Oil leakage		None	6(17.6)	None	Leakage Stopped	None	None
Hypotony		None	14(41.2)	None	None	None	None
Recurrent vitreous hemorrhage		6 (25)	4(11.8)	Cleared Partially	Cleared Partially	Cleared	Cleared
Visual Acuity	Improved	14 (58.3)	18(52.9)	Further improved from first day 12 (50)	Further improved from first day 16 (47)	No further improvement	No further improvement
	Same	2 (8.3)	12(35.31)	12 (50)	18 (52.9)	-	-
	Reduced	8 (33.3)	4 (11.8)	-	-	-	9 (26.4)
Lens changes		None	None	None	None	None	9 (26.4)

accidental puncture of conjunctival or episcleral vessels by sharp trocar during port formation.

In 25 - gauge series, after cannula removal, the sclerotomy sites showed leakage. In 23 - gauge series, 6 eyes (17.6%) showed scanty leakage of silicone oil from one of the sclerotomy site. However, the eyes were quiet and intraocular pressure well maintained so no sutures were applied to seal that sclerotomy port. These six eyes were padded and examined daily. Leakage stopped within 24 - 48 hours and no complications took place.

In 25 - gauge series, intraocular pressure remained within normal range in all cases. Highest IOP of 16 mm Hg in 2 eyes and lowest IOP of 8 mm Hg in 3 eyes, while in 23 - gauge, transient low IOP was recorded in 14 eyes (41.2%) with IOP of 4 mm Hg in four eyes, 6 mm Hg in four eyes and 8 mm Hg in six eyes. Eyes without silicone oil tamponade were the ones with lower IOP. The intraocular pressure returned to normal range with 24 - 72 hours post-op. No pressure related ocular complications (e.g. choroidal detachment etc.) developed.

Transient vitreous hemorrhage was seen in greater number in 25 - gauge series (6 eyes, 25%) than in 23 - gauge series (4 eyes, 11.8%). This is probably due to greater number of diabetic patients with vitreous

hemorrhage in 25 - gauge series with retinal neovessels. These vessels are fragile and bleed easily.

Visual acuity results were almost identical in both series. In 25-gauge series, 14 cases (58.3%) improved, 8 cases (33.3%) reduced and 2 cases visual acuity remained unchanged. In 23 - gauge series, 18 cases (52.9%) showed improvement, 12 cases (35.3%) reduced and 4 eyes (11.8%) remained unchanged (Table 2).

1 Week follow-up

In both series, intraocular pressure returned to baseline values in all with no IOP related complications.

In both series, partial clearing of vitreous hemorrhage was seen in affected eyes (6 eyes in 25 - gauge, 4 eyes in 23 - gauge series). Visual acuity further improved in both series from day 1 follow-up readings. In 25 - gauge series, 12 eyes and in 23 - gauge series, 16 eyes improved further (Table 2).

1 Month, 3 Month follow-up

In 25 - g and 23 - g series, eyes with transient vitreous hemorrhage showed complete clearing of vitreous cavity.

In 23 – g series, minimal lens changes were seen in 9 cases at 1 month which worsened by 3 months follow-up. Silicone oil fill resulted in early cataract formation in all these cases.

Visual acuity remained stable in all except those with cataract formation.

DISCUSSION

Since the introduction of vitrectomy in the early 1970s, numerous retinal conditions like retinal detachment, macular hole and diabetic retinopathy are managed surgically. Recently, the procedure has undergone a series of revisions, allowing for smaller angled incisions that do not require suture support and are self sealing, thus, potentially laying the groundwork for a more efficient and patient friendly procedure. Besides 20 – gauge systems, today 23 – and 25 – gauge systems are marketed by ophthalmic device makers.

Simplicity of entry is desirable, and that's why a one-step angled incision was made in both 23 and 25 – gauge series with self-retaining cannula. Both techniques (25 – and 23 – gauge) required stabilizing the eye on entry into the globe. However, greater pressure was applied when forming ports with 23 – gauge trocar mounted cannula. This is probably due to smaller size of 25 – gauge (0.5 mm) wound as compared to 23 – gauge (0.7 mm) requiring greater pressure on trocar – cannula insertion. No entry site retinal tears were seen in either group. This compares well with published data. Fine et al⁴ reported no intra-operative sclerotomy site tears in 77 patients undergoing 23 – gauge vitrectomy. However, their study was only on 23 – gauge technique and not 25 – gauge.

In comparison to 23 – g, 25 – g PPV is much more tedious and requires careful handling. The instruments are thin, flexible and bend easily with threat of breakage. Luckily, no instrument broke but bending of 25 – g fiberoptic light occurred during surgery in every case. Also, peripheral vitreous shaving was incomplete in 25-g series as globe rotation was difficult due to flexible instruments and scleral indentation helped complete the work. Inoue M et al⁵ in his case series reported intra-operative breakage of 25 – g cutter during vitrectomy, while Tomic et al⁶ reported bending of 25 – g light pipe during surgical procedure. No such problems arose in 23 – g series. The instruments were rigid, allowing easy rotation of globe and complete peripheral vitreous shaving.

On completion of pars plana vitrectomy, suture closure was not needed in any case in either series. Though scanty leakage of silicone oil was observed in 6 eyes (17.6%) in 23 – gauge series, suture closure wasn't required as IOP was maintained within normal range. Misra et al⁷ also reported similar findings with only one out of one hundred and fifty cases requiring suturing of a sclerotomy port while Eckardt's⁸ series of forty four patients needed no port sutured. Lakhanpal et al⁹ in his 25-gauge series reported 10 cases (7.1%) requiring suture placement at a single sclerotomy site.

Post-operative hypotony following both 23 – and 25 – gauge suture less vitrectomy has been raised as a concern in the literature.^{2,4,6} In our 25 – gauge group, IOP readings were within normal range while in 23 – gauge series, fourteen eyes (41.2%) showed low IOP readings of ≤ 8 mmHg on the first postoperative day. Majority of non silicone oil filled eyes received fluid (internal) tamponade. None of these patients developed hypotony related complications like choroidal detachment. IOP returned to normal range within first 48 – 72 hours with no adverse outcome on visual acuity. Similar data was published by Misra et al⁷, reporting transient hypotony (IOP < 10 mm Hg) in four (out of fifty) eyes in 23 – gauge series on first postoperative day which normalized within 2 weeks of surgery with no complications and stable vision. However their study was between 23 – g and 20 – g series and not 25 – g. Tomic et al⁶ published their comparative study between 23 – g and 25 – g PPV and reported a higher rate (41%) of transient hypotony in their 25 – gauge series compared to 14% in 23 – gauge group.

Localized minor sub-conjunctival hemorrhage occurred in a few patients in either group [4 of 24 (16.7%) in 25 – g and 8 of 34 (23.5%) in 23 – g group]. This happened as a result of accidental puncture of conjunctival vessels by trocar during sclerotomy. Another author⁷ has also reported similar finding. The hemorrhage cleared spontaneously within a few days.

25 – g group showed a greater percentage of transient vitreous hemorrhage (25%) on first follow-up than the 23 – g group (11.8%). This difference is probably due to patient selection in the respective group. Majority of patients in 25 – g series were diabetics with PDR with vitreous hemorrhage as a complication of PDR. Thus, the diabetic retinal new vessels are more vulnerable and prone to re-bleed with trivial trauma or even ocular movements. In 23 –

g group, there was greater variety of posterior segment disease and silicone oil for internal tamponade was used in many patients. Tomic et al⁶ have published a 2% transient post-op VH in 25 - g and 1% in 23 - g series. They too had similar selection of patients in the respective groups.

Finally, visual acuity improved in all cases in both groups from their pre-op values. Except for transient vitreous hemorrhage which resolved spontaneously, no case in either series required repeat vitrectomy till the last follow up (3 months).

CONCLUSION

In summary, 25 and 23 - gauge suture less vitrectomies are safe and minimally invasive. They enhance post-operative recovery. In our experience, 23-gauge vitrectomy system offers advantages of suture less system, larger and stiffer instrumentation and is suitable for a wider variety of indications. For 25 - gauge vitrectomy, we need to select vitreo-retinal conditions requiring minimal tissue manipulations and dissection. Overall, both procedures induce minimal ocular trauma, decrease inflammatory response and allows faster patient and visual recovery. Further studies with longer follow-ups are warranted to determine if procedures involving more extensive fibrovascular proliferation should be performed especially with 25 - gauge instruments.

Author's Affiliation

Dr. Huma Kayani
Associate Professor
FJMC / SGRH, Lahore

Dr. Aamir Ahmed
Assistant Professor
FJMC / SGRH, Lahore

Dr. Kashif Jahangir
Senior Registrar
SGRH, Lahore

Dr. Hizb-ur- Rehman
PG Trainee
SGRH, Lahore

Dr. Khurram Chauhan
PG Trainee
SGRH, Lahore

REFERENCES

1. **Fujii GY, De Juan E Jr, Humayun MS, Chang TS, Pieramici DJ, Barnes A, Kent D.** Initial experience using the transconjunctival sutureless vitrectomy for vitreoretinal surgery. *Ophthalmology*. 2002; 109: 1814-20.
2. **Soni M, McHugh D.** 23-gauge transconjunctival sutureless vitrectomy: a way forward. *Eye News*. 2007; 14: 18-20.
3. **Chen E.** 25 - gauge transconjunctival sutureless vitrectomy. *Curr Opin Ophthalmol*. 2007; 18: 188-93.
4. **Fine HF, Iranmanesh R, Iturralde D, Spaide RF.** Outcomes of 77 consecutive cases of 23 - gauge transconjunctival vitrectomy surgery for posterior segment disease. *Ophthalmology* 2007; 114: 1197-1200.
5. **Inoue M, Noda K, Ishida S, Nagai N, Imamura Y, Oguchi Y.** Intraoperative breakage of 25 - gauge vitreous cutter. *Am J Ophthalmol*. 2004; 138: 866-9.
6. **Tomic Z, Gili JN, Theocharis I.** Comparison between 25-gauge and 23 - gauge sutureless vitrectomy techniques. *Retina Today* 2007; 4 (1):
7. [http:// www.retinatoday.org/rt/rt.nsf/url? OpenForm&id=19](http://www.retinatoday.org/rt/rt.nsf/url?OpenForm&id=19).
8. **Misra A, Yen GH, Burton RL.** 23-gauge Sutureless Vitrectomy and 20-gauge Vitrectomy: A Case Series Comparison. *Eye* 2009; 23: 1187-91.
9. **Eckardt C.** Transconjunctival sutureless 23-gauge vitrectomy surgery. *Retina*. 2005; 25: 208-11.
10. **Lakhanpal RR, Hamayun MS, Juan Jr ED, Lim JJ, Chong LP, Chang TS, Javaheri M, Fujii GY, Barnes AC, Alexandrou TJ.** Outcomes of 140 Consecutive Cases of 25 - Gauge Transconjunctival Surgery for Posterior Segment Disease. *Ophthalmology*. 2005; 112: 817-24.