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ORIGINAL ARTICLE

Comparison of Characteristics and Clinical Outcomes between 27 versus 23 Vitrectomy Gauge in Diabetic Vitrectomy Surgery

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Abstract

Background: ***The most serious type of diabetic eye disease, proliferative diabetic retinopathy, affects about 1.4% of all diabetics around the world.***

Aim: ***To find out how well 27-G and 23-G probes work in diabetic vitrectomy surgery by looking at their effectiveness, operating time, the need for sutures, inflammation after surgery, control of intraocular pressure, and problems during and after surgery.***

Patients and methods: ***Thirty diabetics who had been confirmed with diabetic retinopathy were the subjects of a prospective comparative interventional study. There were two separate groups of thirty people with diabetes: Within Group (1), fifteen patients were given a 23-gauge needle & within Group (2), fifteen patients were given a 27-gauge needle. Patients wanting a Vitrectomy went to the Ophthalmology Department, Faculty of Medicine, Al-Azhar University Hospitals from March 2022 to March 2023.***

Results: ***When the two groups were compared in terms of operation time, there was no significant difference within either Group (p >0.05). As a result, Group (1) had a quicker core vitrectomy than Group (2). This is a substantial distinction among (p = 0.027). Comparing the two groups' postoperative problems didn't show much difference & the difference wasn't statistically significant (p >0.05). There are fewer bleeding and/or irritations after 27-gauge instrumentation because its width is smaller. This means that fewer sutures are needed during sclerotomies. Unfortunately, the instruments' fineness may also make the treatment & surgery take longer, which may lead to more inflammation.***

Conclusion : ***This study indicate that 27-gauge instrumentation, by virtue of its finer diameter, generates more precise incisions. Consequently, this may result in diminished inflammation and/or hemorrhaging, as well as a decreased need for sutures during sclerotomies.***

Keywords: 23-gauge tool; Diabetic Vitrectomy; 27-gauge tool; Diabetic retinopathy

1. Introduction

The most severe kind of diabetic eye disease, proliferative diabetic retinopathy, is believed to have a global prevalence of about 1.4 percent among all individuals diagnosed with diabetes. Retinal neovascularization is a prevalent factor contributing to vitreous hemorrhage in proliferative diabetic retinopathy, which can result in severe, immediate vision loss. Vitreous hemorrhage occurred in 46 percent & 48% of eyes with untreated, proliferative diabetic retinopathy in the DRCR Retina Network Protocol S was observed. Over a period of five years, respectively, despite the administration of ranibizumab & pan-retinal photocoagulation.[1,2]

The implementation of 23-gauge instruments commenced in 2005. The surgeon was capable of performing transconjunctival vitrectomy with the aid of these instruments; however, they were slightly larger & technically advanced, featuring reduced flexibility & an enhanced inner lumen that facilitated light transmission & improved flow. Due to the substantial improvement, a considerable number of surgeons elected to exclusively utilize this gauge of toots instead of 20 gauge.[3,4]

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Lately, instruments measuring twenty-seven gauges have become available. While these instruments are even more compact than the 25-gauge ones, their enhanced design (which involves twin-duty cycle cutters), combined with improved vitrectomy devices that offer efficient vacuum & flow rates & significantly enhanced light sources (involving xenon & LED), enable the surgeon to execute a considerable proportion of pars plana vitrectomy (PPV) cases utilizing this method. Suturing is seldom necessary for incisions of this nature owing to their exceedingly minute dimensions. Typically, incisions close spontaneously upon the retraction of instruments from the eye. Additionally, postoperative recovery can be remarkable; in fact, the results are frequently excellent. It is challenging to determine which eye underwent surgery on that particular day. Following the procedure. [5]

The goal of this research was for comparison. between 27-G & 23-G probes in diabetic vitrectomy surgery in efficacy of each technique in various cases, operative time: from insertion of vitrectomy probe till its removal, need of suturing, postoperative intraocular inflammation, IOP control, intraoperative and postoperative complication.

2. Patients and methods

A prospective comparative interventional research was carried out on a group of thirty diabetic cases who were diagnosed with diabetic retinopathy. Thirty cases of diabetes were divided into two equal categories.: Group (1) Included 15 patients in whom a 23-gauge needle was used, and Group (2) involved fifteen patients in whom a 27-gauge needle was used. Patients attended the Ophthalmology Department, Faculty of Medicine, Al-Azhar University Hospitals, seeking for Vitrectomy from March 2022 to March 2023.

Inclusion criteria: Adult subjects: Age more than 18 years old, both sexes included, patients with diabetic retinopathy &capable of conducting an assent confirmation.

Exclusion criteria: Low age cases <18 years; cases who had prior vitrectomy; patients with undergone major ocular surgery; patients with ocular trauma, pregnant or lactating mother, patients with severe systemic diseases; chronic renal failure, congestive cardiac failure, or liver cell failure; those who decline to participate in the research.

Methodology

A complete assessment was done for each patient, including Complete history recording, laboratory findings, and ocular examination.

Ocular examination

Slit lamp biomicroscopy examines the anterior segment of the eye in order to rule out deformities of the cornea or lens. Manifest refraction using the autorefractometer. Determination of IOP. Fundus Examination. Fundus OCT for determination of macular edema

Procedure:

A single vitreoretinal surgeon conducted all procedures, employing identical surgical parameters for both the 27-gauge & 23-gauge platforms. Operations were done under local or general anesthesia according to the patient cooperativity.

Common steps in vitrectomy surgery include: An antiseptic solution was used to clean & sanitize the eye, after which it was dilated &covered with a sterile covering. A speculum was utilized to maintain the eye's openness, while a protective covering was applied to the non-operating eye. By means of the pars plana, a structure located in the sclera or white portion of the eye, the surgeon gains access to the eye. Utilizing the standard 3-par plana ports (one for infusion &two for intraocular instrumentation), vitrectomy surgery incorporated these ports. A vitrectomy probe or vitrector was utilized by the surgeon to puncture the vitreous gel, & a suction device was employed to remove the degraded fluid. The surgeon will use forceps, scissors & cutters to excise scar tissue from the retina. They will then employ a silicone-tipped needle to extract infected, cloudy, or bloody fluid. Additionally, a laser probe will be utilized to address abnormal BL vessels and clots and to seal off retinal injuries, such as tears or holes, as determined by the specific case. The vitreous substitute employed by the surgeon was similar to saline solution, silicone oil, gas, or air bubbles. To prevent infection, an antibiotic ointment was administered to the eye, followed by covering it. Instructions are provided while the individual remains face down for a period of time, dependent upon the nature of the additional procedures performed on the eye. The operative time (from the moment the vitrectomy instrument was inserted until it was removed) and gauge type were documented. We used the patient's most recent pre-op appointment as our baseline, & our most recent follow-up appointment as our finish line. IOP of 5 mmHg or less was considered for hypotony.

Postoperative follow-up:

Recorded data from follow-up visits within three months after the procedure in 1 week and after 1 or 3 months postoperatively. A follow-up assessment includes the following: IOP measurements were taken at each consultation. A slit lamp biomicroscopic examination was done to assess conjunctival incision and scleral healing and to search for any new signs or complications after surgery. Visual acuity testing and fundus examination were done at suitable times.

Ethical considerations

The research protocol obtained approval from the Committee of Ethics of Scientific Research, Faculty of Medicine, Al-Azhar University, in addition to the Research Ethics Committee and the Studies Committee (Local Research Committee). Written informed assent was obtained from every patient.

Statistical analysis:

Collected data were presented in a master sheet table that is performed in Microsoft Excel Worksheet (Microsoft, New York, USA). The statistical package SPSS version 25.0 (SPSS Inc., Chicago, IL, USA) was utilized to analyze the data. To evaluate the normality of the variable distribution, the Kolmogorov–Smirnov test was applied. In contrast, qualitative data were presented in the form of figures & percentages (%) rather than means ± SD. In order to compare statistical differences in quantitative data, the Student t-test was employed. Chi-Square was used for qualitative data. Tables and suitable graphs are analyzed and drawn electronically by the computer.

3. Results

Group (1) comprised 7 males (46.7percent) & 8 females (53.3percent), while group (2) also comprised 7 males (46.7 percent) & eight females (53.3percent). The age distribution of group (1) was as follows: 48 to 64 years, with average ± SD of 54.4 ± 13.4 years; group (2) had members aged 46 to 66 years, with a mean ± 8.99 years. Age & gender were matched between the two groups; however, the p-value (>0.05) was not substantial in static. (Table 1)

Table 1. Patients' features of the two researches groups.

GROUPS	GROUP (1)		GROUP (2)		SIGNIFICANCE	
GENDER	No.	%	No.	%	x^2	P
MALES	7	46.7	7	46.7	0.000	1.000
FEMALES	8	53.3	8	53.3	0.000	1.000
TOTAL	15	100	15	100		
AGE (YEARS)	Min	Max	Min	Max	t	P
RANGE	48	64	46	66		
MEAN ± SD	54.4 ± 13.4		55.7 ± 8.99		0.461	0.719

x2 = Chi square, t: unpaired t-test, SD: standard deviation.

Group (1), 23G, required more air/gas tamponade and more sutures than group (2), 27G with statistically highly substantial variations (p <0.001), while other operative procedures like cataract extraction+IOL and ILM peeling was elevated in group (1) than group (2) but didn't reach significance (p >0.05). (Table 2)

Table 2. Comparison of operative procedures among the two studied groups.

INTRAOPERATIVE PROCEDURES	23G PPV		27G PPV		SIGNIFICANCE	
	No.	%	No.	%	χ^2	P
CATARACT +IOL	6	40.0	5	33.3	1.431	0.054
VITAL DYE USED	6	40.0	7	46.7	0.854	0.136
AIR/GAS TAMPONADE	6	40.0	1	6.67	16.27	0.000*
SUTURE REQUIRED	8	53.3	2	13.3	7.952	0.000*
ILM PEALING	4	26.7	3	20.0	1.422	0.061

x2: Chi square test, p <0.001 = highly significant, IOL: intraocular lens, ILM: internal limiting membrane.

Comparison between the two studied groups regarding operation time showed non-substantial distinction (p >0.05) among the two groups, while core vitrectomy showed less time in group (1) than group (2) with substantial in static variation (p =0.027). (Table 3)

Table 3. Comparison of operation time between the two researches groups.

OPERATION TIME (MINUTES)	GROUP (1) 23G PPV	GROUP (2) 27G PPV	SIGNIFICANCE	
			t	P
MEAN ± SD	15.1 ± 4.75	16.2 ± 4.14	0.523	0.125
RANGE	6.7 – 16.7	7.5 – 17.4		
CORE VITRECTOMY	4.23 ± 2.05	7.11 ± 3.46	1.367	0.027*
RANGE	4.3 – 7.1	6.2 – 8.3		

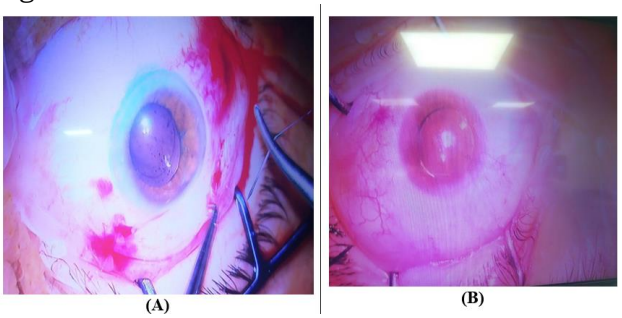
t: student t-test, p >0.05 = non-significant, *p <0.05 = significant.

Closure of sclerectomy pores by The rate of suturing group (1) had a far higher value than group (2). (p0.001), with a statistically very highly significant difference (p0.001). Conversely, the rates of spontaneous closure & pressure closure were much greater in group (2) than in group (1) (p0.001 & P =0.006, respectively). (Table 4)

Table 4. Comparison of action on sclerotomy among the two studied groups.

ACTION TO CLOSE SCLEROTOMY	23G PPV		27G PPV		SIGNIFICANCE	
	No.	%	No.	%	χ^2	P
NONE	4	26.7	8	53.3	8.121	0.000*
PRESSURE	3	20.0	5	33.3	1.483	0.006*
SUTURING	8	53.3	2	13.3	8.356	0.000*
TOTAL	15	100	15	100		

x2: Chi square test, p <0.001 = very highly significant.



(A) (B)

Figure 1: (A): Suturing in 23-gauge case and (B): Suturless closure in 27-gauge case

The incidence of postoperative complications was comparable between the two groups. statistically insignificant difference (p >0.05) (Table 5)

Table 5. Postoperative complications of the two studied groups.

POSTOPERATIVE COMPLICATION	23G PPV		27G PPV		SIGNIFICANCE	
	No.	%	No.	%	χ^2	P
HYPOTONY	5	33.3	4	26.7	0.002	0.877
AC FLARE	3	20.0	3	20.0	0.000	1.000
VITREOUS HEMORRHAGE	1	6.67	0	0.00	0.078	0.189
RETINAL TEAR/RD	1	6.67	0	0.00	0.078	0.189
REMAINING PATHOLOGY	1	6.67	3	20.0	7.185	0.000*
TOTAL	11	73.3	10	66.7	0.811	0.058

x2: Chi square test, p <0.001 = highly significant, AC: anterior chamber, RD: retinal detachment.

There was insignificant distinction among the two groups as regard VAS, eye redness score & best corrected visual acuity (BCVA). (Table 6)

Table 6. Measurements of some parameters of the two researches groups.

MEASUREMENTS	23G PPV		27G PPV		SIGNIFICANCE	
	Mean	±SD	Mean	±SD	t	P
PAIN (VAS)	2.25	0.51	1.75	0.25	0.470	0.123
EYE REDNESS SCORE	2.02	0.05	1.25	0.03	0.415	0.142
BCVA (DECIMAL)	0.51	0.22	0.52	0.23	0.235	0.314

VAS: Visual analogue scale, BCVA: best corrected visual acuity, P >0.05: non-significant.

4. Discussion

Group (1) comprised seven males (46.7 percent) & eight females (53.3%), while Group (2) also comprised seven males (46.7 percent) & 8 females (53.3%). The age distribution of Group (1) was as follows: 48 to 64 years, with an average ± SD of 54.4 ± 13.4 years; Group (2) had members aged 46 to 66 years, with an average ± 8.99 years. There was no statistically significant difference between the sexes or age groups because the p-value was greater than 0.05.

Similarly, patients were obtained in Stalmans[6] study as they studied a total of 80 patients scheduled for PPV with or without phaco surgery comparing between 27G and 23G needles. They found also that ages were similar in both groups with no substantial in static variation (p = 0.4425).

Group (1), 23G, required more air/gas tamponade and more sutures than Group (2), 27G, with highly substantial static variation (p <0.001), while other operative procedures like cataract extraction+IOL and ILM peeling was elevated in Group (1) than Group (2) but didn't reach significance (p >0.05).

Saleh et al.[7] This study investigated the incidence of early postoperative hypotony as well as the frequency of sclerotomy sutures required following the procedure. A statistically significant eighteen percent of eyes undergoing 23-gauge vitrectomy developed self-limiting hypotony shortly after the procedure; on the other hand, twenty-two eyes that had 27-gauge vitrectomy procedures performed. A statistically significant twenty-five percent of the 23-gauge eyes required sclerotomy closure by sutures to complete the operation, whereas none of the eyes in the 27-gauge Group required such closure. Comparing IOP readings immediately prior to and following surgery revealed a temporary yet statistically significant reduction in the 23-gauge Group but not in the 27-gauge Group. This observation aligns with the higher incidence of postoperative hypotony among patients undergoing 23-gauge vitrectomy, which is also consistent with recent research utilizing 27-gauge vitrectomy. [8]

A comparison of the two groups under study in terms of operation time revealed no substantial in static variation (p >0.05). However, Group (1) demonstrated a shorter time for core vitrectomy compared to Group (2), which is a difference that is substantial in static (p = 0.027).

Saleh et al.[7] reported comparable findings, indicating the average total operating time for the two groups was 34.8 ± 11.4 minutes (range 20-60) and 38.8 ± 8.6 minutes (range 25-56), respectively, with no statistically significant difference between the two groups (p=0.116). Every one of the study eyes had anatomic success after vitreous blood or opacities were cleared and ERM or ILM were successfully removed. Standardized BCVA after one month postoperatively was substantially higher in all groups compared to the baseline value, but no time point revealed a statistically substantial among the two groups. BCVA improved from 20/90 at baseline to 20/40 at one month in the 27-gauge Group (p=0.005) and from 20/95 to 20/50 at one month in the 23-gauge Group (p=0.001).

The rate of suturing to close sclerectomy pores in Group (1) had a far higher value than in Group (2). (p0.001), with a substantial static variation (p0.001). Conversely, spontaneous closure or closure by pressure, as compared to Group (1), was substantially higher in Group (2). (p0.001 and P =0.006, respectively).

Stalmans[6] reported comparable outcomes, noting that wound closure was considerably more effortless with 27-gauge as opposed to 23-gauge. The 27-gauge exhibited reduced subsequent reddishness, as assessed by an independent evaluator. A decrease in inflammation was observed with the 27-gauge.

There have been suggestions that angled entry rather than direct entry with 27-gauge trocars may be preferable in order to prevent transient postoperative hypotonic shifts; in our 27-gauge

cases, we utilized a straightforward oblique 1-step technique to insert the trocar & did not observe any clinical indications of sclerotomy leakage. Our 23-gauge cohort's sclerotomy-related findings are comparable to those of other 23-gauge MIVS studies. In a recent report on 23-gauge vitrectomy, for instance, fourteen percent of cases experienced hypotony on the first postoperative day & twenty-nine percent of cases required at least one sclerotomy suture. [9]

There was minimal variation in postoperative complications between the two groups & the no statistically significant change (p >0.05) was found. When looking at best corrected visual acuity (BCVA), there were no discernible variations. eye irritation score, or VAS among the two groups.

Mohamed et al.[10] stated that in the 23-gauge Group, three cases (30.0%) had complications, including two cases with bleeding and one case with residual breaks; in the 25-gauge Group, two cases (20.0%) had complications, including one case with residual breaks and one case with hemorrhage. Statistical analysis revealed no significant variation between the groups (p=0.782), but one case in the 27-gauge Group did develop bleeding. Consistent with our findings, Naruse et al.[11] examined the disparities in success rates among vitrectomies performed at 25 & 27 gauges. In regard to the incidence of intraoperative complications, there was no substantial static variation among the two research groups. Khan et al.[12] utilized a 27-gauge vitrectomy system in conjunction with 23-gauge or 25-gauge vitrectomy instruments. No complications were reported either intraoperatively or postoperatively.

4. Conclusion

This study indicate that 27-gauge instrumentation, by virtue of its finer diameter, generates more precise incisions. Consequently, this may result in diminished inflammation and/or hemorrhaging, as well as a decreased need for sutures during sclerotomies. However, the precision of the instrumentation may also cause a lengthier procedure & a slower surgical process, which may contribute to increased inflammation.

Disclosure

The authors have no financial interest to declare in relation to the content of this article.

Authorship

All authors have a substantial contribution to the article

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Conflicts of interest

There are no conflicts of interest.

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