

20-GAUGE VS 23-GAUGE VITRECTOMY, IN TERMS OF SURGICALLY INDUCED ASTIGMATISM

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ABSTRACT**OBJECTIVES**

To compare the post-operative (post-op) surgically induced mean astigmatism in patients undergoing 20-gauge- and 23-gauge vitrectomy.

METHODOLOGY

Sixty patients were enrolled. Relevant information was recorded in a Performa for each patient. Patients were randomly grouped into A (20-gauge) and B (23-gauge) groups. Astigmatism was recorded by a single technician using the same keratometer for all patients. A single surgeon operated on all patients. Post-operatively, all patients were re-examined after 1 week and 6 weeks, and their surgically induced astigmatism was recorded.

RESULTS

Of 60 patients, 58.6% were males, and 41.4% were females, with a mean age of 53.77 ± 9.63 years. The post-operative astigmatism difference between the two vitrectomy procedures was investigated. In the 20-gauge group, with 30 patients, the mean post-operative astigmatism difference was 2.21 D (± 0.66 SD), with a standard error mean of 0.12. In the 23-gauge group, with 30 patients, the mean post-operative astigmatism difference was 0.74 D (± 0.44 SD), with a standard error mean of 0.08. The degrees of freedom (df) were 58, and the standard error of the difference was 0.145. The t-value was calculated at 10.1504, and the p-value was found to be 0.001, indicating a significant difference.

CONCLUSION

The observation that the 20-gauge group displayed a notably higher mean difference in astigmatism than the 23-gauge group suggests a potential association between the choice of vitrectomy procedure and the extent of astigmatism alteration in post-operative outcomes.

KEYWORDS: Surgically Induced Astigmatism, Micro-Incision Vitrectomy, 23-Gauge Vitrectomy

INTRODUCTION

Robert Machemer developed Modern Pars Plana vitrectomy in 1970.¹ Vitrectomy was carried out to remove the vitreous haemorrhage. Steve Charles revolutionized the whole spectrum of treating vitreoretinal diseases.² Vitrectomy is done for vitreous haemorrhage, rhegmatogenous retinal detachment, tractional retinal detachment, macular hole, macular pucker, and endophthalmitis.^{3,4,5} Modern vitrectomy procedures also include membranectomy, fluid/air exchange, air/gas exchange, silicon oil injection, photocoagulation, and lensectomy.⁶ Complications directly related to vitrectomy are iatrogenic retinal breaks, cataract, vitreous haemorrhage, and anterior segment neovascularization.⁷ Complications associated with silicon oil includes emulsification, glaucoma, and band keratopathy. Endophthalmitis, sympathetic ophthalmia, and recurrent corneal erosions can occur after any intraocular procedure.^{8,9} Vitrectomy has conventionally been performed with 20-gauge

instruments. Advances in vitreous surgery are the development of 23-, 25-, and 27-gauge vitrectomy systems. 23-, 25-, or 27-gauge trocars are placed that allow access into the vitreous cavity.¹⁰ With a 25- and 27-gauge vitrectomy system, sometimes there is the inability to perform complicated surgical manoeuvres due to the increased flexibility of the instruments. A 23-gauge trans-conjunctival sutureless vitrectomy has been developed in response to these concerns. 23-gauge surgery involves bevelled, sutureless scleral incisions that are less likely to leak, larger-diameter instruments with increased rigidity, improved light illumination, and the overall ability to perform a more complete vitrectomy in a short time and improved surgical outcomes for patients. Patients do better and have less irritation without sutures, which can leave inflammatory nodules on the surface of the eye and can take weeks or months to reabsorb. Post-operative astigmatism can lead to decrease vision despite successful surgery. The amount of post-operative astigmatism depends on the size, site, and configuration of the incision and the application of

the sutures.^{11,12} In astigmatism, light rays do not focus on a single point. Variations in the cornea or lens curvature at different meridians prevent the light rays in an astigmatic eye from focusing on a single point. In an astigmatic eye, there is no single focal point but two focal lines.¹³

METHODOLOGY

A Quasi experimental study was conducted in the Department of Ophthalmology Medical Teaching Institute, Lady Reading Hospital Peshawar. The duration of the study was 06 Months. The sample size was 60 eyes (30 in each group), calculated with a 95% confidence interval, 80% power of the test, and taking expected mean \pm SD of surgically induced astigmatism in both groups, i.e., 1.48 ± 1.73 in 20-gauge group vs. 0.02 ± 1.38 in 23-gauge group in patients undergoing vitrectomy. The Sampling technique was non-probability consecutive. Patients aged 18 and 65 years, with haemorrhagic retinal detachment, vitreous haemorrhage, macular hole, and Intraocular foreign body, were included in the study. The Patients with documented encirclement surgery, intraocular surgery, any corneal pathology and pre-operative astigmatism of ≥ 2.00 D were excluded from the study. All the above factors are confounders and will make the study result biased if included. All patients fulfilling the study criteria were enrolled. Patients were collected from the outpatient department of Lady Reading Hospital Peshawar. Informed consent was taken. Approval was taken from the ethical committee of the hospital. Demographic (name, age, gender, and address) and medical history were taken. Patients needing vitrectomy were assessed in detail with slit lamp examination, indirect ophthalmoscopy, and ultrasound B scan. Patients will be divided into group A and group B on a lottery basis. Patients in Group A underwent 20-gauge vitrectomy procedures, while patients in Group B underwent 23-gauge vitrectomy procedures. Baseline astigmatism was calculated and noted before surgery from each patient by calculating the difference between horizontal corneal power and vertical corneal power measured with a keratometer. The patients were followed one week and six weeks after the surgery, and post-operative astigmatism was calculated similarly. A single technician used the same keratometer throughout the study. A single experienced ophthalmologist operated on all the patients enrolled in the study. The collected data was analyzed statistically by using SPSS version 20. Quantitative variables like age and astigmatism were presented as mean \pm SD. Qualitative variables like gender, diabetes mellitus, and hypertension were frequency and percentages. P-value was generated using an independent T-test to compare

the significant difference between the mean change in astigmatism of the two groups. Effect modifiers like age, gender, and comorbidities were addressed through stratification. Post-stratification independent T-test was applied to see a significant difference in the outcome between the two groups. The P-value of ≤ 0.05 was considered significant. All the results were presented in tables and graphs.

RESULTS

A total of sixty patients were included in the study. Of them, 31 (52%) were males, and 29 (48%) were females. The minimum age was 24 years, and the maximum was 64 years, with a mean age of 53.77 ± 9.63 years. The pre and post-astigmatism difference of 20G and 23G vitrectomy was also recorded. The mean \pm SD of the difference between pre-and post-op astigmatism of 20G was 1.52 ± 0.51 , and the mean \pm SD of difference between pre-and post-op astigmatism of 23G vitrectomy was 0.08 ± 0.25 . It was found that the mean \pm standard deviation of post-op astigmatism in patients treated with 20-gauge vitrectomy was 2.21 ± 0.66 , and in patients treated with 23-gauge vitrectomy was 0.74 ± 0.44 . The mean of 20-Gauge minus 23-Gauge equals 1.47. 95% confidence interval of this difference: From 1.18 to 1.75.

Table 1: Post-Operative Astigmatism difference of 20- & 23-g Vitrectomy

	N	Mean \pm SD	Standard error mean	Df	Standard error of the difference	t-Value	P-Value
20-g	30	2.21 \pm 0.66	0.12	58	0.145	10.1504	0.001
23-g	30	0.74 \pm 0.44	0.08				

*P-Value = 0.002

DISCUSSION

In this study, there were 58.6% male and 41.4% female patients Out of 60 patients. 50% of patients underwent 20-gauge vitrectomy procedures, while 50% experienced 23-gauge vitrectomy procedures. Aftab et al. had 70 patients divided into two groups.¹⁴ Raza et al. had 40 patients divided into two groups.¹⁵ Park et al. operated on 20 eyes in each group.¹⁶ Hikichi et al. had 100 eyes divided into two groups to remove the macular membrane. They operated on these patients for a year.¹⁷ Misra et al. had 50 patients in their study.²¹ Wimpissinger et al. had 60 patients in their study in two groups.²² The overall mean \pm standard deviation of pre-op astigmatism was observed as 0.74 ± 0.41 D, and the overall mean \pm standard deviation of post-op astigmatism was observed as 1.47 ± 0.93 D. Whereas in patients undergoing 20-gauge vitrectomy, post-op astigmatism mean and standard deviation was

calculated as $2.21 \pm 0.66D$, and in patients undergoing 23-gauge vitrectomy, post-op astigmatism mean, and standard deviation were calculated as $0.78 \pm 0.50D$. Wimpissinger et al. compared the sutureless 23-gauge system with the conventional 20-gauge system in PPV for various vitreoretinal disorders. He reported that the opening and closure times were significantly shorter, and the duration of vitrectomy was significantly longer in 23 gauge compared to 20 gauge. However, the degree of retinal manipulation and the overall duration of surgery did not differ significantly between the groups.²⁰ Sutureless trans-conjunctival vitrectomy in 23- and 25-gauge can be a good choice for cases like full-thickness macular holes, epi-retinal membranes, diabetic tractional RDs.²² Table 2,3,4,5, and 6 shows the values of mean pre-op astigmatism, mean post-op astigmatism and mean surgically induced astigmatism amongst the two groups of 20-gauge and 23-gauge vitrectomy systems. This study's objective was to compare the means of post-op astigmatism in both groups. The results showed that the mean of post-op astigmatism in a 23-gauge vitrectomy procedure was less than that in a 20-gauge vitrectomy procedure. So, our study revealed that a 23-gauge vitrectomy is more effective and useful than a 20-gauge vitrectomy procedure. The post-op mean of 20-gauge vitrectomy was observed as $2.21 \pm 0.66D$, while on the other hand, the post-op mean of 23-gauge vitrectomy was $0.74 \pm 0.44D$. In a previous study, corneal topographies of patients undergoing 20-gauge and 23-gauge vitrectomies were also compared. The astigmatism induced surgically in 18 patients undergoing 20-gauge vitrectomy was $1.48 \pm 1.73D$ at the end of the first post-op week, while in 25 patients undergoing 23-gauge vitrectomy was $0.02 \pm 1.38D$. The mean \pm standard deviation of the difference between pre-and post-op astigmatism in the 20-gauge vitrectomy procedure was 1.52 ± 0.51 , and in the 23-gauge vitrectomy procedure was 0.08 ± 0.25 . For comparison, we have used the T-test for significant differences between mean astigmatism in both groups. We have found a significant difference between astigmatism in both groups with p -value = 0.000. Our research revealed that 23-gauge vitrectomy induces less post-op astigmatism and gives better visual results than 20-gauge vitrectomy.

LIMITATIONS

This study limitations should be acknowledged when interpreting the results and considering their broader implications.

CONCLUSIONS

This study has revealed that a 23-gauge vitrectomy

procedure results in less post-op astigmatism and better visual outcome than a 20-gauge vitrectomy.

CONFLICT OF INTEREST: None

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REFERENCES

1. Kessner R, Barak A. Pseudophakic rhegmatogenous retinal detachment: combined pars plana vitrectomy and scleral buckle versus pars plana vitrectomy alone. *Graefes Archive for Clinical and Experimental Ophthalmology*. 2016 Jun 1;254(11):2183–9.
2. Batawi H. Pars plana vitrectomy versus combined pars plana vitrectomy and scleral buckle for repair of primary rhegmatogenous retinal detachment with inferior retinal breaks. *Morressier*; 2020.
3. Nakabayashi M, Fujikado T, Ohji M, Saito Y, Tano Y. Fixation Patterns of Idiopathic Macular Holes After Vitreous Surgery. *Retina*. 2000 Feb;20(2):170–5.
4. McDonald HR, Johnson RN, Johnson RN, Ai E, Jumper JM, Fu AD. Vitreoretinal surgery for idiopathic epiretinal membranes. *Vitreoretinal Surgical Techniques*. Routledge; 2019. p. 325–36.
5. Shah R, Gupta O. Principles and Techniques of Vitreoretinal Surgery. *Expert Techniques in Ophthalmic Surgery*. Jaypee Brothers Medical Publishers (P) Ltd.; 2015. p. 197–197.
6. Bilgin AB, Dogan ME, Aysun B, Apaydin KC. Pars plana vitrectomy with or without intraoperative 360° peripheral endolaser for rhegmatogenous retinal detachment treatment. *Int Ophthalmol*. 2019;39(8):1687–94.
7. Petrovich A. Epidemiological Study of Proliferative Diabetic Retinopathy Treatments for the Vision-Threatening Complications of Diabetic Macular Edema. *Endocrinology and Disorders*. 2018 Sep 16;2(4):01–3.
8. Henry CR, Schwartz S, Flynn H Jr. Endophthalmitis following pars plana vitrectomy for vitreous floaters. *Clinical Ophthalmology*. 2014 Aug;1649.
9. Takai Y, Sakanishi Y, Okamoto M, Ebihara N. Sympathetic ophthalmia after 27-G pars plana vitrectomy. *BMC Ophthalmology*. 2021 May 2;21(1).
10. Charles S. 25-Gauge Sutureless Transconjunctival Vitrectomy. *Principles and Practice of Vitreoretinal Surgery*. Jaypee Brothers Medical Publishers (P) Ltd.; 2014. p. 106–106.
11. Corneal Topographic Changes After Four Types of Pterygium Surgery. *Journal of Refractive Surgery*. 2008 Jan;24(2):160–5.
12. Watanabe A, Ninomiya W, Mizobuchi K, Watanabe T, Nakano T. Corneal shape changes after vitreoretinal surgery with fluid-gas exchange. *Medicine*. 2022 May 6;101(18):e29205–e29205.
13. Rush RB, Simunovic MP, Sheth S, Kratz A, Hunyor AP. Pars Plana Vitrectomy Versus Combined Pars Plana Vitrectomy–Scleral Buckle for Secondary Repair of Retinal Detachment. *Ophthalmic Surgery, Lasers and Imaging Retina*. 2013 Jul;44(4):374–9.
14. Rajappa S, Bhatt H. Minimizing surgically induced astigmatism in non-phaco manual small incision cataract surgery by U-shaped modification of scleral incision. *Indian Journal of Ophthalmology*. 2020;68(10):2107.
15. Kessner R, Barak A. Pseudophakic rhegmatogenous retinal detachment: combined pars plana vitrectomy and scleral buckle versus pars plana vitrectomy alone. *Graefes Archive for Clinical and Experimental Ophthalmology*. 2016 Jun 1;254(11):2183–9.
16. Tayyab H, Khan AA, Sadiq MAA, Karamat I. Comparison of 23 gauge transconjunctival releasable Suture Vitrectomy with standard 20 gauge Vitrectomy. *Pakistan Journal of Medical Sciences*. 2018 Apr 5;34(2).

17. Chaban YV, Popovic MM, Garg A, Muni RH, Kertes PJ. Pars Plana Vitrectomy Port Sizes: A Meta-Analysis of Randomized Controlled Trials. *Ophthalmic Surgery, Lasers and Imaging Retina*. 2022 Mar;53(3):152–8.
18. Optics of the Human Eye. *Optical Devices in Ophthalmology and Optometry*. Wiley; 2014. p. 15–48.
19. Irfan Muslim, Asad Aslam Khan, Nasir Chaudhry. ANATOMICAL AND VISUAL OUTCOME OF COMBINED PHACO-VITRECTOMY VS VITRECTOMY ALONE. *Pakistan Postgraduate Medical Journal*. 2021 Jun 3;31(04):204–9.
20. Watanabe T, Gekka T, Watanabe A, Nakano T. Analysis of Changes in Corneal Topography after 27-Gauge Transconjunctival Microincision Vitrectomy Combined with Cataract Surgery. *Journal of Ophthalmology*. 2019 Jul 10;2019:1–5.
21. Claes C, Lafetá AP. 20 Gauge Sutureless Vitrectomy [Internet]. Minimally Invasive Vitreous Surgery: 20 Gauge to 27 Gauge. Jaypee Brothers Medical Publishers (P) Ltd.; 2013. p. 167–167.
22. Charles S, Ho AC, Dugel PU, Riemann CD, Berrocal MH, Gupta S, et al. Clinical comparison of 27-gauge and 23-gauge instruments on the outcomes of pars plana vitrectomy surgery for the treatment of vitreoretinal diseases. *Curr Opin Ophthalmol*. 2020;31(3):185–91.

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