

Frequency of Post-Operative Hypotony with Sutureless Sclerotomy versus Intrasceral Hydration in 23-Gauge Pars-Plana Vitrectomy

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ABSTRACT

Purpose: To compare the frequency of hypotony after 23-gauge (G) pars plana vitrectomy (PPV) with sutureless sclerotomy versus intrasceral hydration for sclerotomy closure in eyes with air/gas tamponade.

Study Design: Quasi-experimental study.

Place and Duration of Study: College of Ophthalmology and Allied Vision Sciences, Mayo Hospital, Lahore from November 2021 to May 2022.

Methods: A total of 90 eyes were included who underwent PPV with air/gas tamponade. One group underwent PPV with sutureless sclerotomy while the other got intrasceral hydration for sclerotomy closure. Intraocular pressure (IOP) was measured pre and post-operatively at day one and day seven by applanation tonometry in all eyes. IOP of 6 mmHg or less was defined as hypotony. Primary endpoint measure was rate of early post-operative hypotony.

Results: A total of 90 eyes of 90 patients, 40 (44.4%) males, and 50 (55.6%) females were included in the study. Five (5.6%) patients reported hypotony, out of which, only one (2.2%) case was seen in the intrasceral hydration group while rest (8.9%) were of the sutureless group. Sclerotomies requiring sutures were 4.44% (6 of 135) in sutureless group while 0.74% (1 of 135) in intrasceral hydration group. Paired sample T-test for the means of pre-operative and post-operative IOP was significantly different in both groups. For sutureless PPV, mean difference was 3.089 ± 7.960 mmHg ($P = 0.013$), while for the intra scleral hydration group, it was 3.778 ± 7.048 mmHg ($p = 0.001$).

Conclusion: Intrasceral hydration is a suitable option for PPV sclerotomy closure without having any side effects.

Key Words: Hypotony, pars plana vitrectomy, intrasceral hydration, 23 gauge (G), intraocular pressure (IOP).

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INTRODUCTION

Trans-conjunctival sutureless vitrectomy (TSV) is arguably the biggest advance in vitreoretinal surgical practice since the initiation of pars plana vitrectomy

(PPV) as an indispensable tool in 1971. With the advent of 23 and 25-gauge (G) TSV, the 20G PPV has become obsolete.^{1,2} The PPV done with 23G instrument, for instance, features a 0.72mm width incision wound that self-seals with the intraocular pressure forcing the wound borders shut.³ TSV has added benefits of reduced time to full recovery and reduced surgical trauma because of a small incision. This also leads to decreased conjunctival scarring, reduced post-operative inflammation and less post-operative astigmatism contributing to overall comfort for the patient.⁴

Whereas TSV has its advocates, some complications have been noted in the form of hypotony and endophthalmitis resulting from poor wound closure.⁵ Imperfect scleral wound closure can be quite common even if the recommended guidelines of using the angled-incision approach are used in addition to excellent conjunctival placement and appropriate massage of the surgical wound.⁶

There is a wide variability in the reported rates (0-25%) of post-operative hypotony following TSV.⁷ While hypotony is typically temporary, it can sometimes lead to further vision threatening complications of choroidal detachment, choroidal hemorrhage, hypotony maculopathy, sub-conjunctival gas leakage and inadequate tamponade.⁸ As a result, some groups do advocate scleral sutures even in the case of 23G PPV to avoid such complications. Other time-efficient methods of mitigating these side effects have also been explored in the medical literature. These include bipolar diathermy, tissue adhesives and releasable sutures.⁹

The standard practice at our hospital is to apply sutures with 23G PPV. In this study, we performed PPV without sutures and investigated the prognosis in such cases. We, furthermore, explored the effect of intrasceral hydration in ameliorating the unwanted side effects of TSV.

METHODS

A quasi-experimental study was conducted at Eye Unit-III, COAVS, Mayo Hospital, Lahore from November 2021 to May 2022 after approval from the ethical review board. A total of 90 eyes of 90 patients were included by consecutive sampling with Confidence level as 95% and level of precision as 0.05.¹⁰ All patients with age 18 years and above who underwent PPV for air/gas tamponade were included. Patients with preoperative intraocular pressure (IOP) of less than six mmHg, those who had silicone oil as tamponade, underwent combined scleral buckling and PPV procedure, patients who were unable to maintain supine posture and mentally handicapped patients were excluded. A written informed consent was collected from each patient before participating in this study. Patients were counseled regarding need, advantages, and disadvantages of the procedure.

All eyes included in the study underwent comprehensive ocular examination including visual acuity, slit lamp biomicroscopy of the anterior

segment, fundus evaluation with 90 D and indirect ophthalmoscopy with 20 D, and IOP measurements with a Goldmann applanation tonometer. History, age, gender, status of lens and indication of surgery were noted. All surgeries were performed by the same surgeon. Standard three-port sclerotomies with 23G trocars were performed; two of which at superior nasal and temporal and the third at the inferior temporal quadrants in all eyes. The trocar was first inserted tangentially through the sclera and then it was oriented towards the disc 3.5 or 4 mm from the limbus depending on whether patient was pseudophakic or phakic.

Patients were divided in two groups. For wound closure, one group remained suture-less without any additional maneuver while the other got intrasceral hydration. In all cases, wound closure was confirmed by the absence of leaking air when BSS was dripped over the sclerotomy. For intrasceral hydration group, a 30G needle filled with BSS was inserted in a transconjunctival fashion, parallel to the sclera and adjacent to the external flap of the sclerotomy after removing the trocar. Once inside the scleral stroma, a little amount of BSS was injected till the evidence of sclerotomy air-leakage halt. After the infusion trocar was removed and intrasceral hydration, an extra amount of gas or air was injected with a 30G needle to refill the eye.

The intraoperative data regarding the surgical procedure and type of tamponade used were recorded. IOP was measured pre and post-operatively at day one and day seven by applanation tonometry. IOP of six mmHg or lower was defined as hypotony. Primary endpoint was rate of early post-operative hypotony. Secondary outcome was the number of eyes requiring sutures for sclerotomy closure on first post-operative day. In Figure 1 we show a flow Chart of Study Process depicting incidence of hypotony in both groups and number of sclerotomies requiring sutures.

Statistical analysis was performed using SPSS 25. Descriptive statistics were applied to summarize mean values and standard deviations of all the numerical data. A p-value of < 0.05 was considered statistically significant. Mean difference in IOP were measured.

RESULTS

A total of 90 eyes of 90 patients were included. Forty (44.4%) were males and 50 (55.6%) were females. Mean age of the participants was 52.2 ± 13.19 years

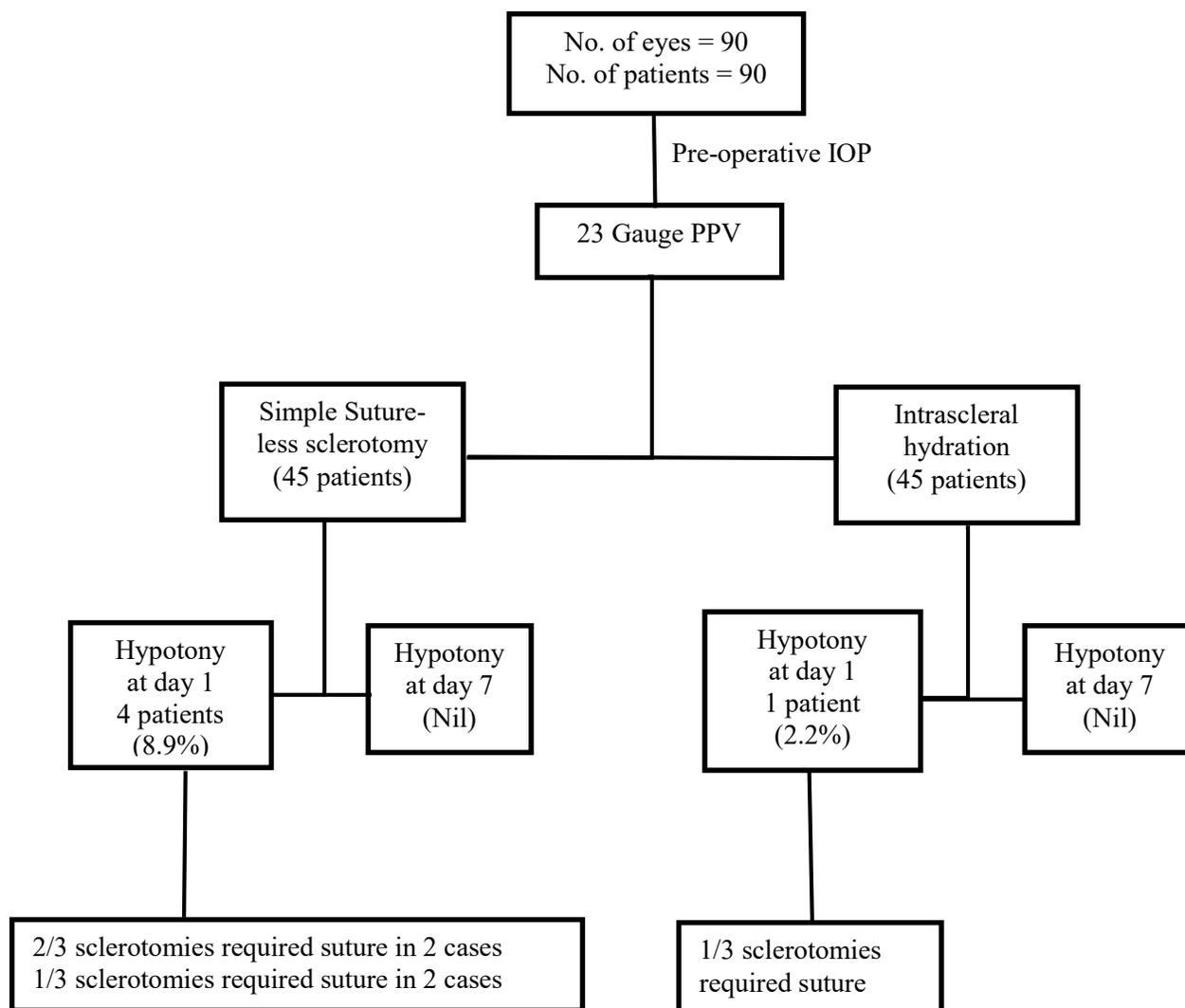


Figure 1: Flow Chart of Study Process showing incidence of hypotony in both groups and number of sclerotomies requiring sutures. IOP=intraocular pressure, PPV=Pars-plana vitrectomy.

(range: 17 – 71). The diagnoses of 90 eyes are shown in table 1. Of the total eyes, 26 (28.9%) eyes were phakic, 54 (60%) were pseudo-phakic and 10 (11.1%) were aphakic. Systemic comorbidities included Hypertension and Diabetes mellitus in 35 (38.9%) patients and 28 (31.1%) individuals respectively. Mean pre-operative IOP was 14.89 ± 4.35 mmHg (range 6 – 28). For eyes that underwent sutureless PPV, moderate visual impairment (<6/18 – 6/60) was present in 13 eyes, while 32 eyes had vision less than 3/60. The later included counting finger (CF) vision in 11 eyes, hand movement (HM) in 15 eyes, while six eyes had light perception (PL) only. For eyes in the intrascleral hydration group, mild visual impairment (up to 6/18) was present in one eye, moderate visual impairment in 15 eyes, severe visual impairment

(<6/60 – 3/60) in one eye, and 28 eyes had less than 3/60 (15 had CF vision, seven had HM and six had PL+).

Of the agents used for tamponade, air was injected in 38 eyes (42.2%), Sulfur hexafluoride (SF₆) in 26 (28.9%) and perfluoropropane (C₃F₈) in 26 eyes (28.9%).

Five (5.6%) patients reported hypotony, out of which, only one (2.2%) case was seen in the intrascleral hydration group while four (8.9%) were in the suture-less group. A total of five eyes required sutures for closure of sclerotomies of which three (3.3%) eyes required one, and two (2.2%) eyes required two sutures. Sclerotomies requiring sutures were 4.44% (6 of 135) in suture-less group while

0.74% (1 of 135) in intrasceral hydration group.

On postoperative day one, the mean IOP was 11.46 ± 5.14 mmHg (range: 4 – 25). Fourteen patients had complications (Table 2), of which five (5.55%: 5 out of 90) patients had hypotony. Two had isolated hypotony, one had hypotony with insufficient retinal tamponade and two had hypotony with choroidal detachment. Only one isolated case was seen in the intrasceral hydration group. However, Fisher’s exact test failed to show statistical significance.

Spearman’s correlation showed a negative association between hypotony and age (spearman’s $r = -0.235$, $p = 0.026$). Paired sample T-test for the means of pre-operative and post-operative IOP was significantly different in both groups. For suture-less PPV, mean difference was 3.089 ± 7.960 mmHg ($P = 0.013$), while for the intra scleral hydration group, it was 3.778 ± 7.048 mmHg ($p = 0.001$). Independent sample T-test for the difference between postoperative IOP between the two groups was not significant.

Finally, one week postoperatively, the mean IOP was 14.11 ± 3.21 mmHg, and this was not statistically different from the preoperative mean ($p = 0.184$). For eyes in the suture less PPV group, moderate visual impairment was present in 15 eyes, severe visual impairment in one eye, and 29 eyes had less than 3/60, of which 16 had a vision of CF, 10 had HM and three had PL+ vision. For eyes in the intrasceral hydration group, mild visual impairment was present in one eye,

moderate visual impairment in 32 eyes, severe visual impairment in one eye, and 11 eyes had less than 3/60 of which seven had CF vision, two had HM and two had PL+ vision.

Table 2: Postoperative complications.

Group	Diagnosis	Frequency	Percent (%)
Suture-less only	Isolated with choroidal detachment with insufficient tamponade	01	2.2
	Vitreous Hemorrhage	01	2.2
	Endophthalmitis	02	4.4
	Gas Migration under Conjunctiva	01	2.2
	Insufficient Retinal Tamponade	01	2.2
	Total	09	20
	Hypotony	01	2.2
	Vitreous Hemorrhage	02	4.4
	Gas Migration under Conjunctiva	02	4.4
	Total	05	11.1
Intrasceral Hydration			

PPV = pars-plana vitrectomy.

Table 1: Ocular Diagnosis.

Groups	Diagnosis	Frequency	Percent
Suture-less only	Macular hole	11	24.4
	Epiretinal membrane	01	2.2
	vitreous hemorrhage	13	28.9
	Rhegmatogenous RD	13	28.9
	Silicone oil removal subluxated/dropped lens	04	8.9
	dropped IOL	01	2.2
	Total	45	100
Intrasceral hydration	Macular hole	08	17.8
	Epiretinal membrane	03	6.7
	vitreous hemorrhage	05	11.1
	Rhegmatogenous RD	16	35.6
	Vitritis	01	2.2
	Silicone oil removal subluxated/dropped lens	08	17.8
	dropped IOL	02	4.4
Total	45	100	

RD = Retinal detachment, IOL = Intraocular lens

DISCUSSION

Primary benefit of a 23G TSV is to avoid all the complications that may arise due to sutures.¹¹ In this respect, this was a pilot study at our hospital in the sense that whereas 23G instruments were used for Vitrectomy, most procedures invariably used sutures. The frequency of hypotony was quite low ($5/90 = 5.6\%$) in our study. In the hydration group, it was even lower with only one case of hypotony (2.2%) as compared to the other group with 8.9%. These results are consistent with El-Sobky et al, who reported hypotony in 12% cases for the 23G group and 4% for the 25Ggroup.¹² Likewise, Mimouni et al, reported 5.9% cases of hypotony following 25GPPV.¹³ In another study, post-operative hypotony was seen in 24 (48.0%) patients with 23G PPV and 02 (4.0%) patients with 25G PPV (p -value = 0.0001).¹⁴ The general consensus, therefore, is consistent with the hypothesis that 25G PPV has a significantly lesser chance of hypotony compared with the 23G one.

It is to be noted that we have used the standard definition of hypotony as IOP being less than or equal to six mmHg. On the other hand, in the literature

Pasaogluet al, have reported hypotony rates between 21 and 23% for 23G TSV by including all cases of IOP less than or equal to 10 mmHg.¹⁵ If we take this definition, we arrive at 51.1% and 33.3% cases of 'hypotony' in the TSV and TSV followed by hydration groups, respectively.

Sclerotomies that required sutures were 4.44% (6 of 135) in sutureless group while 0.74% (1 of 135) in intrascleral hydration group. Our numbers are similar to those of Rizzo et al, who reported that 3.3% of sclerotomy closures required sutures while using intrascleral hydration.¹⁰

It is also noteworthy that the one eye that did require a suture in the hydration group required a single suture. However, in the group without scleral hydration two eyes needed two sutures each while the other two needed one suture each. This may be compared with the results of Veritti et al, that reported up to 29% cases requiring sutures in 25G sclerotomy.¹⁶ Sedova et al, reported a similar rate of 30% eyes needing sutures with 23G sclerotomy.¹⁷ A similar conclusion is also reached by Lopez-Guajardo et al, who have discussed the efficacy of using cyanoacrylate and fibrin glue to achieve wound closure post TSV.¹⁸

No patient in scleral hydration group reported endophthalmitis while two (4.44%) patients in sutureless group developed this vision threatening complication in this particular study. Out of these two, one patient developed endophthalmitis after three days with negative cultures. The second patient developed endophthalmitis after seven days of PPV and pseudomonas was found on culture results. Both patients were given intravitreal antibiotics followed by redo PPV but no improvement in vision was seen. Lin et al, have argued that wound closure in 23G sclerotomy as opposed to the 20G procedure (in which sutures were used) results in poorer wound closure and hence increased chance of endophthalmitis.¹⁹ At least in our limited sample of 45 patients with TSV followed by scleral hydration we did not see any endophthalmitis suggesting that hydration followed by TSV is a good alternative to avoid the complications of sutures.

Our study shows that hydration following TSV is a good alternative to suture closure. We conclude by remarking that various techniques of avoiding sutures have been reported on over the past few years. For instance, Horowitz et al, tried diathermy and

demonstrated its efficacy.⁴Felfeli et al and Zhang et al, reported use of scleral needling for wound closure post-TSV.^{20,6} Sridhar et al, report on the relative efficacy of plain gut sutures versus the more standard polyglactin sutures.²¹ It would be interesting to compare these various techniques against hydration as a means of developing a standard protocol for use at least locally.

The limitations of our study were the short follow-up and that we did not look into risk factors that lead to leaking sclerotomy such as high myopia, thin sclera, multiple instrument exchanges, retinal detachment repair, prior history of PPV, extended peripheral vitrectomy or combined phacovitrectomy.²⁰

CONCLUSION

Intrascleral hydration is a suitable option for sclerotomy closure without any side effects in PPV with air or gas tamponade.

Ethical Approval

The study was approved by the Institutional review board/Ethical review board (COAVS/1107/2021).

Conflict of Interest: Authors declared no conflict of interest.

REFERENCES

1. **Uy HS, Cabahug VLO, Artiaga JCM, Chan PS, Famadico JT.** Clinical Outcomes of a Beveled Tip, Ultra-High Speed, 25-Gauge Pars Plana Vitrectomy System. *BMC Ophthalmol.* 2022; **22 (1)**: 93-103. doi: 10.1186/s12886-022-02311-3.
2. **Otsuka K, Imai H, Fujii A, Miki A, Tagami M, Azumi A, et al.** Comparison of 25- and 27-Gauge Pars Plana Vitrectomy in Repairing Primary Rhegmatogenous Retinal Detachment. *Journal of Ophthalmology*, 2018; **7643174**: 1-5. doi:10.1155/2018/7643174.
3. **Zahra Q, Khaqan HA, Abdullah M, Imtiaz U.** Frequency of Post-Operative Hypotony after 23-Gauge Transconjunctival Vitrectomy with Locally Made Instruments. *J Pak Med Assoc.* 2019; **69 (7)**: 1032-1034.
4. **Horowitz S, Damasceno NA, Muralha F, Pereira MB, Maia M, Damasceno EF.** Diathermy for 23-Gauge Sclerotomy: A Functional and Morphologic Study to Avoid Ocular Hypotony. *Clin Ophthalmol.* 2019; **13**: 1703-10. doi:10.2147/OPHTH.S209813.

5. **LaGrow AL, Schatzman SN, Amayem OA, Bradford RH, Shah VA, Chen S, et al.** Endophthalmitis after Transconjunctival Pars Plana Vitrectomy: A 6-year Experience without Prophylactic Intraoperative Subconjunctival Antibiotics. *Retina*. 2021; **41 (3)**: 531-537. doi: 10.1097/IAE.0000000000002905.
6. **Zhang Y, Zhu D, Zhou J.** Needle Infusion Avoids Using Sutures and Prevents Hypotony in the 23 Gauge Sutureless Vitrectomy. *Int J Clin Exp Med*. 2015; **8 (10)**: 19176-19179.
7. **Yoneda K, Morikawa K, Oshima Y, Kinoshita S, Sotozono C.** Japan Microincision Vitrectomy Surgery Study Group. Surgical Outcomes of 27-Gauge Vitrectomy for Consecutive Series of 163 Eyes with Various Vitreous Diseases. *Retina*. 2017; **37 (11)**: 2130-2137. doi:10.1097/IAE.000000000000144.
8. **Mohamed S, Claes C, Tsang CW.** Review of Small Gauge Vitrectomy: Progress and Innovations. *J Ophthalmol*. 2017; **6285869**: 1-9. doi:10.1155/2017/6285869.
9. **Tosi G, Malandrini A, Bacci T, Posarelli M, Oddone C, Virgili G.** Vitreous Incarceration in Sutured Vs Non-Sutured Sclerotomies After 25-Gauge Macular Surgery. *Eye*, 2021; **35**: 2246-2253. doi:10.1038/s41433-020- 01234-x.
10. **Rizzo S, Pacini B, De Angelis L, Barca F, Savastano A, Giansanti F, et al.** Intrasceral hydration for 23-Gauge Pars Plana Vitrectomy Sclerotomy Closure. *Retina*. 2020. doi: 10.1097/IAE.0000000000002703.
11. **Li J, Liu SM, Dong WT, Li F, Zhou CH, Xu XD, et al.** Outcomes of Transconjunctival Sutureless 27-Gauge Vitrectomy for Vitreoretinal Diseases. *Int J Ophthalmol*. 2018; **11 (3)**: 408-415. doi: 10.18240/ijo.2018.03.10.
12. **El-Sobky HM, Othman IS, Zaky AG, Salama AA.** Evaluation of surgical outcomes of 23-G versus 25-G vitrectomy for pediatric retinal detachment. *Menoufia Med J*. 2021; **34**: 1499-1504.
13. **Mimouni M, Abualhasan H, Derman L, Feldman A, Mazzawi F, Barak Y.** Incidence and Risk Factors for Hypotony After 25-Gauge Pars Plana Vitrectomy with Nonexpansile Endotamponade. *Retina*. 2020; **40 (1)**: 41-46. doi:10.1097/IAE.0000000000002336.
14. **Khaqan HA, Imtiaz U, Buksh HM, Rehman HAU, Naz R.** Frequency of Post-Operative Hypotony in 23 Gauge and 25 Gauge Pars Plana Vitrectomy in Advanced Diabetic Eye Disease. *Pak J Ophthalmol*. 2020; **36 (4)**: 335-350. doi: 10.36351/pjo.v36i4.1016.
15. **Pasaoglu I, Cakir M.** Outcomes of 23-Gauge Transconjunctival Sutureless Vitrectomy in Patients with Diabetic Retinopathy. *Beyoglu Eye J*. 2021; **6 (3)**: 243-248. doi:10.14744/bej.2021.38278.
16. **Veritti D, Sarao V, Lanzetta P.** A Propensity-Score Matching Comparison between 27-Gauge and 25-Gauge Vitrectomy Systems for the Repair of Primary Rhegmatogenous Retinal Detachment. *J Ophthalmol*. 2019; **2019**: 3120960. doi: 10.1155/2019/3120960.
17. **Sedova A, Steiner I, Matzenberger RP, Georgopoulos M, Scholda C, Kriechbaum KF, et al.** Comparison of Safety and Effectiveness Between 23-Gauge and 25-Gauge Vitrectomy Surgery in Common Vitreoretinal diseases. *PLoS One*, 2021; **16 (3)**: e0248164. doi: 10.1371/journal.pone.0248164.
18. **López-Guajardo L, Benítez-Herrerros J, Donate-López J, Opazo-Toro V.** Evaluation of Leakage Resistance Improvement in Transconjunctival Sutureless Vitrectomy Sclerotomies Closed With Adhesives. An Experimental Study. *Eye Lond*. 2020; **34 (7)**: 1229-1234. doi: 10.1038/s41433-019-0651-4.
19. **Lin Z, Feng X, Zheng L, Moonasar N, Shen L, Wu R, et al.** Incidence of Endophthalmitis After 23-Gauge Pars Plana Vitrectomy. *BMC Ophthalmol*. 2018; **18 (1)**: 16-20. doi: 10.1186/s12886-018-0678-5.
20. **Felfeli T, Altomare F, Mandelcorn ED.** Sutureless Closure of 23- and 25-Gauge Leaking Sclerotomies with the Scleral Needling Technique. *Retina*. 2020; **40 (5)**: 838-844. doi: 10.1097/IAE.0000000000002484.
21. **Sridhar J, Kasi S, Paul J, Shahlaee A, Rahimy E, Chiang A, et al.** A Prospective, Randomized Trial Comparing Plain Gut to Polyglactin 910 (VICRYL) Sutures for Sclerotomy Closure After 23-Gauge Pars Plana Vitrectomy. *Retina*. 2018; **38 (6)**: 1216-1219. doi: 10.1097/IAE.000000000000168.

Authors' Designation and Contribution

Amna Rizwan; Vitreoretina Trainee: *Concepts, Literature search, Data acquisition, Manuscript preparation.*

Sidrah Latif; Senior Registrar: *Data analysis, Statistical analysis.*

Rana Muhammad Mohsin Javaid; Senior Registrar: *Design, Data acquisition.*

Tehseen Mahju; Senior Registrar: *Data acquisition, Statistical analysis.*

