IATROGENIC RETINAL BREAKS DURING CONVENTIONAL 20-G PARS PLANA VITRECTOMY

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ABSTRACT

Purpose: To describe the pattern of iatrogenic retinal breaks during conventional standard 3-ports Pars Plana Vitrectomy (PPV) in terms of frequency, causes and risk factors.

Materials and methods: Prospective interventional case series conducted on 62 eyes which underwent 20-gauge PPV from January 2018 to January 2019. The data collected was reviewed to determine the frequency, causes and risk factors of iatrogenic retinal breaks in vitrectomy surgery.

Results: The mean age of patients was 38 years. Overall, the frequency of iatrogenic retinal breaks was 27.41 %. Most of the breaks were observed posterior to the equator (64.70 %). Iatrogenic retinal breaks were more frequent in cases operated for tractional retinal detachment (46.15 %) followed by rhegmatogenous retinal detachment (RRD) (31.82 %) and vitreous hemorrhage (22.22 %). The vitreous cutter probe was found the most common causative instrument (41.17 %) while peeling of fibrovascular membranes in tractional retinal detachment (TRD), peripheral vitreous shaving near sclerotomy sites and peeling of fibrovascular tractional membranes were the common predisposing risk factors for retinal breaks.

Conclusion: Iatrogenic retinal breaks were more frequent in cases operated for TRD. Peeling of fibrovascular membranes and peripheral vitreous shaving near sclerotomy sites was among the common predisposing risk factors for iatrogenic retinal breaks.

Keywords: Iatrogenic Breaks, Pars Plana Vitrectomy

Abbreviations: Gauge (g), Pars Plana Vitrectomy (PPV), Tractional Retinal Detachment (TRD), Rhegmatogenous Retinal Detachment (RRD)

INTRODUCTION

Vitrectomy has been the mainstay surgical treatment for various retinal diseases that cause profound visual loss. Previously, inoperable entities such as rhegmatogenous retinal detachment, persistent vitreous hemorrhage, diabetic eye complications and Intraocular Foreign Body (IOFB) are now successfully treated with vitrectomy surgery. The aim of PPV consists of clearing media opacities, releasing vitreoretinal tractions, peeling of visually significant epiretinal membranes and flattening of detached retinal with internal tamponade agents of silicone oil and gas. Besides all the advantages of PPV, complications are still an unavoidable part even in good surgical hands. Probably, it is very challenging to completely eliminate the common intraoperative complication of iatrogenic retinal break formation during vitrectomy surgery even if great intraoperative measures are taken. However, it is fortunate to see and encounter these complications commonly away from the posterior pole, thus not influencing the visual and surgical outcome significantly.

The recent addition of Microsurgical Vitrectomy Systems (MVS) of 23-g, 25- and 27-g trocars to the vitreoretinal surgery allow fast and less invasive surgery. Additionally, these modern vitrectomy machines have higher cut rates to allow quick, safer and efficient surgery compared conventional 20-g vitrectomy. These innovative microsurgical vitrectomy systems help the surgeons in radical shaving of the peripheral vitreous with minimal tractions applied on the adjacent retina and hence low chance of iatrogenic retinal breaks formation. Moreover, the wide-angle viewing systems, the modern endoillumination devices and the endolaser with curved probes have enabled surgeons to perform more precise photocoagulation with minimum chances of iatrogenic retinal breaks and retinal redetachment. Despite advances in vitreoretinal surgery in recent years, including the advent of small-gauge cannulated systems, retinal tears at the time of surgery are still a major complication, even in the hands of experienced vitreoretinal surgeons.[1.2.3]

20-g PPV is still a popular and commonly performed procedure by vitreoretinal surgeons in world wide. Secondary retinal detachment caused by intraoperative iatrogenic retinal breaks remains the most common sight-threatening complication of this surgery

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despite the recent advances in wide-angle viewing systems and instrumentation.[4] However, intraoperatively timely recognition and treatment of breaks would likely alter this result. Rhegmatogenous retinal detachment (RRD) after PPV is a significant postoperative complication and is often secondary to sclerotomy-related retinal breaks.[5,6] In another study conducted on diabetic cases, intraoperative complications were iatrogenic retinal tear (13.5%), iatrogenic retinal hemorrhage (4%) and fibrinoid reaction (3.3%).[7] In another review of 11618 vitrectomy operations, the most common complications were iatrogenic retinal tears (3.2%), lens touch (0.9%), and iatrogenic retinal trauma (0.7%).[8] The frequency of iatrogenic retinal breaks during PPV has been reported to range from 0 to 24%.[2,6,9] Intraoperative break formation is much more frequent during vitrectomy for TRD, and the reported rates range from 27% to 50% of eyes.[10-13]

To prevent recurrent or post vitrectomy retinal detachment, avoiding of intraoperative break formation in vitrectomy surgery is as critical as the successful detection of retinal breaks. Significantly high frequency of iatrogenic retinal breaks during vitrectomy surgery is a serious concern and of paramount importance to the vitreoretinal surgeon. Therefore, surgery must be performed with full understanding of the predisposing risk factors and the causative instruments and knowledge of the limitations of the conventional vitrectomy system. Adopting this approach will help surgeons to anticipate and promptly treat iatrogenic retinal breaks. Keeping in view the concern of a high incidence of retinal break formation during vitrectomy, this study was designed to observe and review our experience of iatrogenic retinal breaks formation with 20-gauge PPV in our population.

MATERIALS AND METHODS

An interventional case series was conducted in the Eye Department, Hayatabad medical complex Peshawar from January 2018 to January 2019. The patients included in the study were thoroughly examined at the slit lamp. The patients then underwent standard 20-g PPV using a non-contact wide-angle viewing system of the Binocular Indirect Ophthalmic Microscope (BIOM). The operative notes were recorded and the demography of patients, indications of vitrectomy, causes, risk factors, and the iatrogenic retinal breaks observed were recorded and analyzed. The surgeries were performed either under local or general anesthesia. Scleral ports were made 3.5 mm behind the limbus in pseudophakic or aphakic eyes and 4 mm behind the limbus in phakic eyes. The iatrogenic retinal break was defined as a full-thickness break in the neurosensory retina that occurred during surgery. The anterior break was defined as any break located anterior to the equator of retina. Retinal breaks identified preoperatively were not counted in the study. At the end of the surgery, breaks were applied laser retinopexy or cryotherapy, followed by intraocular gas or oil tamponade injection. All cases were performed by vitreoretinal fellows.

RESULTS

A total of 62 eyes having vitrectomy surgery were analyzed for iatrogenic retinal breaks. The mean age of patients was 38 years, having male gender predominance with male to female ratio of 1.95:1. (Figure 1)

41 eyes (66.13 %) were phakic and 41 eyes (33. 88 %) were pseudophakic. Primary surgical indications for PPV included RRD in35.48 %, TRD in 20.97% and vitreous bleed in 14.52 %. (Table I)

Overall, the frequency of iatrogenic retinal breaks was 27.41%, with most of the breaks observed posterior to the equator 64.70%. Eyes having TRD and RRD had a higher frequency of iatrogenic retinal breaks of (46.15 %) and (31.82 %) respectively, followed by vitreous bleed with 22.22 %. (Table II)

The vitreous cutter probe was the most common causative instrument (41.17%). (Table III)

Peeling of fibrovascular membranes in tractional retinal detachment (TRD), peripheral vitreous shaving near sclerotomy sites and surgical inducing of a posterior vitreous detachment (PVD) were the common risk factors threatening retina to iatrogenic retinal breaks during surgery.

DISCUSSION

The vast clinical experience and ongoing improvements in surgical techniques have made vitrectomy a more safe procedure with minimal complications and good surgical results. In retinal detachment surgery, one of the keys to successful surgical outcomes is to remove the vitreous completely to release traction, especially in areas of pathology to enable the retina to get reattach with internal tamponades. However, it is here where most of the vitreoretinal surgeons encounter complications like lens touch, iatrogenic tears, and intraoperative bleeding. Breach in basement membrane of posterior lens capsule and neurosensory layer of retina are undesired events of vitrectomy. Large defects in posterior lens capsule hurdles in implantation of Intraocular Lens (IOL) while breaks in neurosensory layer make retinal attachment difficult, with chances of re-detachmment if breaks not properly sealed by barraging with laser. Vitreoretina surgeons require fine surgical skills and

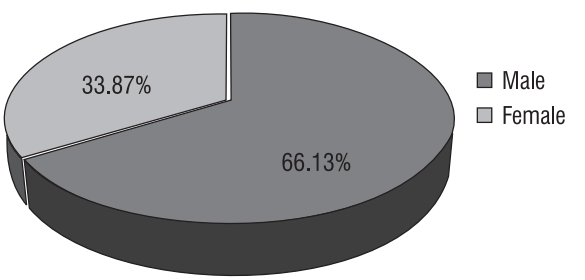

Figure 1: Gender distribution

Table 1: Frequency and location of iatrogenic breaks

Indication for PPV	Total eyes n (%)	Eyes with iatrogenic breaks n (%)	Location of breaks	
			Anterior n (%)	Posterior n (%)
TRD	13 (20.96)	6 (35.29)	3 (50)	3 (50)
RRD	22 (35.48)	7 (41.17)	3 (42.85)	4 (57.15)
Vitreous bleed	9 (14.51)	2 (11.76)	0	2 (100)
IOFB	8 (12.90)	1 (5.88)	0	1 (100)
Dislocated intraocular lens	4 (6.45)	1 (5.88)	0	1 (100)
Retained lens fragments	3 (4.83)	0	0	0
Idiopathic Macular hole	3 (4.83)	0	0	0

Table 2: Causes agents of iatrogenic Breaks

Causes	Number of eyes n (%)
Cutter Probe	7 (41.17)
Endoillumination probe	3 (17.64)
Flute Needle	3 (17.64)
Membrane peeling forceps	2 (11.76)
Endolaser probe	2 (11.76)

Table 3: Predisposing risk Factors for iatrogenic Breaks

Indication of surgery
Peeling of fibrovascular membranes
Peripheral vitreous shaving near ports
Induction of PVD
Fluid-liquid-Oil Exchange
Hazy view due to Lens opacity, corneal edema, vitreous bleeding
Endolaser

expertise to avoid these unwanted events. Aim of vitrectomy surgery is to re attach the neurosensory retina to its anatomical position without causing iatrogenic damage to it. This study was carried out to look at iatrogenic breaks of any type associated with PPV, including scleral ports related breaks, occurring in inducing PVD, breaks encountered in membrane peeling, and breaks caused by the vitreous cutter, endoillumination probes, and flute needles. Retinal break is one of the major complications of vitreous surgery.[14,15]

Overall, the frequency of iatrogenic retinal breaks in our study was 27.41%, with most of the breaks observed posterior to the equator 64.70 %. The results vary in comparing to 3 10, and 15% of intraoperative iatrogenic retinal break reported in other studies.[1,16,17] This variation in our study results is likely to be due to the differences in surgical indications, presentation of cases and vitrectomy system. In our study eyes presenting with TRD had a higher frequency of iatrogenic breaks with 46.15 % compared to 32.45% showed by Dogramaci et al.[16] Likewise, we found that eyes operated for RRD and vitreous hemorrhage had a frequency of 31.82 % (7 of 22 cases) and 22.22 % (2 of 9 cases), respectively. Most of the breaks were located posterior to the equator (64.70 %) while breaks anterior to the equator were mostly adjacent to the sclerotomies and ora serrata. Almost 74 % of the anterior breaks were near the sclerotomies. In a study conducted by Ray T.Oyakawaet al.[18] iatrogenic retinal tears occurred in 20%, with 34% retinal tears anterior to the equator and 66% posterior to the equator.

Handling probes of vitreous cutter and endoillumination while shaving vitreous completely especially in vitreous hemorrhage cases and membrane peeling forceps for peeling fibrovascular and epiretinal membranes particularly in TRD were the key surgical tools responsible for most of the iatrogenic retinal breaks in our cases. We found vitreous cutter the leading causative factor for retinal breaks in 41.17 %. Similarly, flute needle and endolaser probes used in liquid air or fluid air exchange maneuvers and photocoagulation respectively were found too at times contributing to retinal breaks formation in (17.64%). In cases with dropped IOLs, lens material was polymethyl metha acrylic acid (PMMA). Haptics of hard IOLs were responsible for causing retinal damage and break formation during its removal. It has been noted in previous studies that using intraocular scissors and/or forceps for membrane peeling and cutting during PPV increases the risk of iatrogenic retinal breaks.[16]

Fibrovascular membranes were a risk factor that was associated with a higher frequency of iatrogenic retinal breaks in our study. The primary indication for surgery in addition to lens status particularly with opacity and intraoperative corneal edema were the important risk factor for both anterior and posterior iatrogenic retinal breaks. It may be because of the higher risk of vitreous base traction in posteriorly positioned sclerotomies in phakic eyes and partly because of poor visualization of the retina. Additionally, crystalline lens

limits to extensively remove peripheral vitreous with a higher risk of vitreous incarceration in ports and retinal breaks. On the other hand, eyes with pseudophakia and aphakia permit comprehensive peripheral vitreous shaving thereby minimizing entry site complications. Wimpissinger *et al* [6] and Chung *et al* [19] did not find a correlation between retinal break formation and lens status in their studies. Induction of posterior vitreous detachment (PVD) using vitrectomy vaccum was a risk factor predisposing retina to breaks formation while engaging vitreous with probe. We found the induction of PVD particularly in diabetic patients a risk factor for iatrogenic breaks formation. Eyes with thick fibrovascular membranes and requiring induction of PVD often led to bleeding and break formation at the posterior pole. Moore *et al* [2] found no statistically significant association between posterior vitreous detachment (PVD) induction and retinal breaks in a retrospective observational series. Tan *et al*[9] reported a 15.8% incidence of intraoperative breaks having a statistically significant relationship with PVD induction in their 177 cases of 25-gauge transconjunctival sutureless vitrectomy (TSV).

Clear view of the surgical field is very important to carry out smooth and successful surgery, particularly in closed chamber procedures such as vitrectomy. Performing in blind increases the complication rate. Hence it is recommended to remove cataractous lens and vitreous opacities before approaching to retina to minimize risk of iatrogenic breaks during surgery. Similarly, by the time fluid liquid oil exchange is required, the cornea gets edematous enough to obscure the visibility of fundus. By now the risk of iatrogenic retinal breaks increases with flute needle. Hence silicone tips for flute needle are recommended to avoid inadvertent retinal damage.

Despite the recent development in surgical techniques, vitrectomy in diabetic patients is still a challenge. Micro-incision vitrectomy surgery with 23, 25 or 27-gauge has improved the success of vitrectomy with a better understanding of intraoperative parameters and technique of complex surgical manoeuvers. James E et al. [20] observed an increased risk of iatrogenic retinal break in RRD cases undergoing 20-G, 5.8% compared to 23-G vitrectomy 1.9%. It is thought to be due to minimal traction at the vitreous base with minimal chance of a retinal break. Additionally, it also offers the advantage of reduced surgical duration and more rapid visual recovery.

To minimize the risk of iatrogenic breaks, the key is to know the clinical profile of the case and understanding of the vitrectomy system, mastering the skill of handling probes, flute needles and membrane peeling forceps, caution with inserting or exchange of instruments and always operate in the light. It is also important to do a 360-degree examination of the retina with an indentation for better visualization and to allow shaving of the peripheral anterior vitreous gel and treatment of breaks immediately. However, further research is needed to determine the factors for complications, the relation of indication with its success, the effect of co-entities on success.

CONCLUSION

Iatrogenic retinal breaks are more frequent in TRD and rhegmatogenous retinal detachment. A vitreous cutter is the leading causative instrument for the iatrogenic break. Fibrovascular membranes and peripheral vitreous shaving are the risk factors for breaks.

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