

## CONTEMPORARY TRENDS IN VITREORETINAL SURGERY

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**Objectives:** To present the hospital based data on the evolving trends in most important vitreoretinal disorders requiring surgical intervention.

**Design:** prospective observational consecutive case study.

**Patients and Methods:** Data for all patients admitted for vitreoretinal surgery between 2014 and 2019 in a single tertiary healthcare centre were analysed.

**Results:** This study included 1520 vitreoretinal surgeries in 1056 patients (1.44 per patient). The mean age of all patients was 61.27±11.87 (range 6 to 88). A total of 44.34% surgeries were performed on female patients and a total of 50.72% right eyes were operated. The most important indications for vitreoretinal procedures were: retinal detachment 33.09%, advanced diabetic retinopathy 32.17%, complications of previous eye surgery 11.05%, diseases requiring macular surgery 9.61% and eye injuries 8.02%. The number of all vitreoretinal surgeries doubled during the study period (p=0.000). There is a trend of a slight age increase in patients requiring vitreoretinal surgeries (p=0.355). Patients tend to present earlier (p=0.000), and with better preoperative visual acuities (p=0.028).

**Conclusion:** The number of vitreoretinal surgeries in Bosnia and Herzegovina is increasing and the indications follow world trends. The late presentation of vitreoretinal patients remains a significant problem that needs to be addressed in the future.

**Keywords:** vitrectomy, visual acuity, presentation, retinal detachment, diabetes

**INTRODUCTION**

Vitreoretinal surgery is a part of ophthalmology that is constantly evolving and improving.<sup>1</sup> Years of technical refinement with development of new surgical instruments have led to a better surgical performance and increasing safety of vitrectomy.<sup>2</sup> Consequently the indications for vitreoretinal surgery are constantly expanding, and it has become the second most common surgery in the human eye.<sup>2,3,4</sup>

The prevalence of vitreoretinal disorders vary across different ethnic groups.<sup>5</sup> The most recent studies have demonstrated that high income countries prefer elective to vitreoretinal surgeries for severe posterior eye segment conditions mostly in elderly patients.<sup>6</sup> On the other side, studies from low and middle income countries have demonstrated high percentage of younger patients with severe posterior segment conditions requiring vitreoretinal surgery. In addition, almost all patients in low income countries present with a significant delay after onset of ocular symptoms.<sup>7</sup> Therefore, knowing the true prevalence of these different conditions could be important in order to appropriately allocate resources and meet the future demands.<sup>8</sup> Vitreoretinal surgery in Bosnia and Herzegovina has

significantly improved in recent years.<sup>9</sup> However, to date there is no available data on indications and vitreoretinal surgery practice in Bosnia and Herzegovina. The aim of this study was to present the evolving trends in the most important indications for vitreoretinal surgery in tertiary health care institution. These information are important in order to determine further priorities in development and training.

**MATERIALS AND METHODS**

This prospective epidemiological study included all consecutive patients from Surgical Department in the Eye Clinic of the University Clinical Centre Tuzla (UCCT) admitted for vitreoretinal surgery in period from January 2014 to December 2019. The current study was approved by the UCCT Ethics Committee. Written informed consent was obtained from all patients after receiving an explanation of the investigative nature and intent of the study and tenets of the Helsinki Declaration were followed as well. University Clinical Center Tuzla is the only tertiary referral center that serves as the main health institution in the Tuzla Canton. It offers the emergency and specialized eye care for patients with ocular or orbital conditions. Tuzla Canton is the north-eastern

part of Bosnia and Herzegovina. It covers the area of 2,649 square km with 445,028 inhabitants. The economy includes industries, commerce, agriculture, tourism, handicraft, and services. Upon hospital admission all patients underwent a complete ophthalmic examination, including visual acuity (VA) testing with Snellen charts, tonometry, detailed slit lamp biomicroscopy examination, pupillary reaction and fundoscopy. Preoperative VA was classified as less than 20/200, 20/200–20/50, and more than 20/40. The following variables were recorded: age, sex, eye side involved, indications for vitreoretinal surgery and the time from ophthalmic symptoms onset to hospital admission. Indications for vitreoretinal surgery were classified as follows: retinal detachment (primary surgery or silicone oil removal), diabetes complications (proliferative vitreoretinopathy, tractional retinal detachment, chronic macular oedema), macular

surgery (epiretinal membrane, full thickness macular hole and vitreomacular traction syndrome), trauma, ocular vascular incidents (vitreous haemorrhage), complications of uveitis, and complications of other ophthalmic surgeries (cataract, glaucoma, and vitreoretinal surgery). In early 2015, UCCT Tuzla started performing procedures for macular surgery. Therefore, all patients were divided into two groups, patients hospitalized before and after January 2015, in order to compare and monitor the trend of changes in patient indications and characteristics. Differences between means were analysed by Student t-test. The Chi-Square or Fisher Exact Test was used to assess the differences between categorical variables. Statistically significant P values were considered those <0.05. The data were analysed using Stata Statistical Software, version 14.0 (StataCorp LP, College Station, Texas, USA).

**RESULTS**

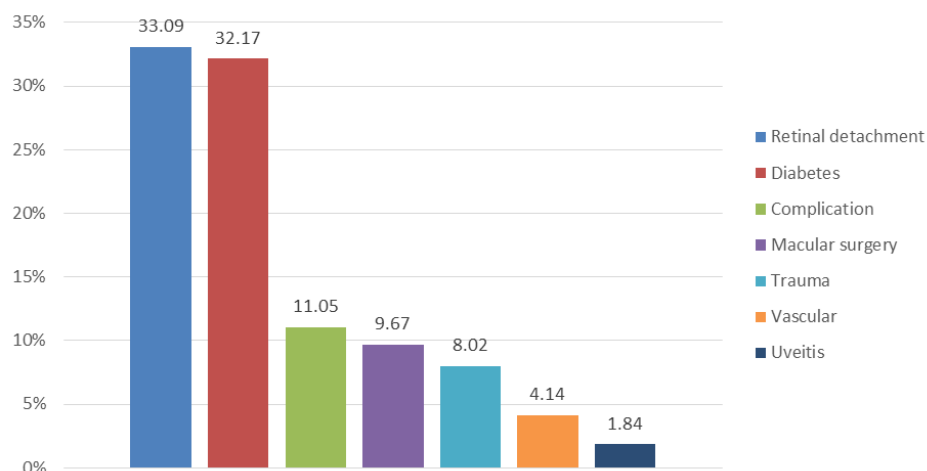
This study included 1520 vitreoretinal surgeries in 1056 patients (1.44 per patient) (Table 1.). Out of 1056 patients, 712 (67.42%; 95%CI:62.56-72.56) had one, 253 patients (23.96%; 95%CI:21.10-27.10) two, and 91 patients (8.62%; 95%CI:6.94-10.58) three and more vitreoretinal

surgeries. The total of 26 patients (2.46%, 95%CI:1.61-3.61) had vitreoretinal surgery in both eyes during the study period. The most important indications for vitreoretinal surgery are presented in Figure 1.

**Table 1.** Characteristics of patients planned for vitreoretinal surgery.

	Whole population	Before MS	After MS	p
<b>Age</b>				
Average age ± SD	61.27 ± 11.87	60.98 ± 11.61	61.31 ± 11.91	0.355
<b>Gender</b>				
Male	846 (56.66%)	101 (53.44%)	745 (55.97%)	0.512
Female	674 (44.34%)	88 (46.56%)	586 (44.03%)	
<b>VA in operated eye</b>				
≤ 20/50	1403 (92.3%)	182 (96.3%)	1221 (91.74%)	0.028
> 20/40	117 (7.7%)	7 (3.7%)	110 (8.26%)	
<b>VA in other eye</b>				
≤ 20/50	1198 (78.82%)	133 (70.37)	1065 (80.01%)	0.002
> 20/40	322 (21.18%)	56 (29.63%)	266 (19.99%)	
<b>Patients with one eye</b>				
	234 (15.39%)	34 (17.99)	200 (15.03%)	0.291
<b>RD onset ±SD (days)</b>				
	20.63 ± 6.31	31.23 ± 8.31	19.23 ± 5.31	0.000

MS – macular surgery, RD – retinal detachment, SD – standard deviation, VA – visual acuity.



**Figure 1.** Most important indications for vitreoretinal surgery

In cases of primary retinal detachment 267 out of 276 patients (96.74%, 95%CI:85.48-109.1) had complete macula detachment. The total of 3 patients (1.09%, 95%CI:0.02-3.18) were admitted within 24 hours, 71 patients (25.72%; 95%CI:20.09-32.44) 2 to 7 days, 102 patients (36.96%; 95%CI:30.13-44.86) 8 days to 1 month and 100 patients (36.23%; 95%CI:29.48-44.07) needed a period of more than a month from visual deterioration to hospital admission. The main indications for diabetic vitreoretinal surgery were: tractional retinal detachment in 193 out of 489 patients (39.47%; 95%CI:44.1-45.45), proliferative vitreoretinopathy 176 patients (35.99%; 95%CI:30.87-41.72), vitreous haemorrhage 67 patients (13.7%; 95%CI: 10.62-17.4) and chronic diabetic macular oedema in 25 patients (5.11%; 95%CI:3.31-7.55). Surgeries for diabetes complications in both periods included significant percentage of tractional retinal detachment cases ( $p=0.241$ ), however only the second period included cases for chronic diabetic macular oedema ( $p=0.000$ ). Average duration of diabetes mellitus was  $13.45\pm 7.21$  years (range 2 to 45), with no significant differences between the periods ( $p=0.323$ ). Total of 436 patients (89.16%; 95%CI:80.99-97.94) received anti-VEGF pre-treatment but only 97 patients (19.84%; 95%CI:16.08-24.2) had laser photocoagulation before vitrectomy. Cases of vitreoretinal surgery for complications included 67 patients (39.8%; 95%CI:30.91-50-65) with retinal redetachment or silicon oil reinstillation, 48 patients (28.57%; 95%CI:21.07-37,88) with complications of cataract surgery, 30 patients (17.86%; 95%CI:12.05-25.49) with recurrent vitreous haemorrhage and other complications including endophthalmitis and trauma cases in 23 patients (13.69%; 95%CI:8.68-20.54). The cases operated for macular surgery included: 61 patients (41.5%; 95%CI:31.74-53.3) with epiretinal membrane, 59 patients (40.14%; 95%CI:30.55-51.77) with full thickness macular hole, 17 patients (11.56%; 95%CI:6.74-18.52) with vitreomacular traction syndrome and 10 patients (6.8%; 95%CI:3.26-12.51) with lamellar macular hole. Average duration of symptoms in these cases was

$13.12\pm 6.91$  months (range 4 to 48).

Temporal changes in indications for vitreoretinal surgery over six year period presented a significantly increased number of procedures for all indications ( $p=0.000$ ) (Figure 2.). During 2019, the operative program was interrupted due to a malfunction in the surgical block, which resulted in a slightly lower number of all surgical procedures. Average age of patients with macular surgery was  $67.84\pm 8.64$ , which was significantly higher than in other indications ( $p=0.000$ ) and a higher number of female patients 64.36% ( $p=0.000$ ). On the other side, the average age of patients with trauma was  $52.52\pm 18.35$ , which was significantly lower than all other indications ( $p=0.000$ ) and a lower number of female patients 21.79% ( $p=0.000$ ). Preoperative VA ranged from light perception to 20/20. Total of 867 (57.04%; 95%CI:53.31-60.97) and 117 (7.7%; 95%CI:6.36-9.23) patients had VA less than 20/200 and more than 20/50 respectively. Furthermore, VA less than 1/200 was recorded in 451 patients (29.67%; 95%CI:26.99-32.54), with a declining trend in the number of these patients ( $p=0.000$ ).

## DISCUSSION

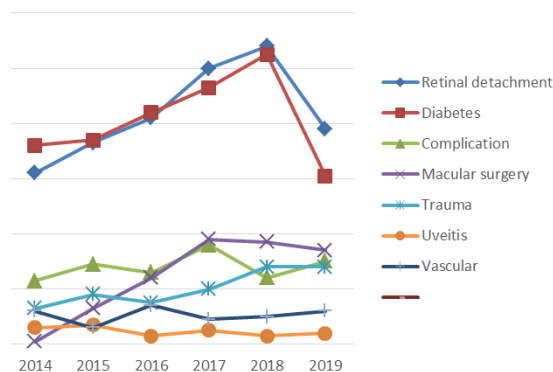
Most blindness prevalence studies focus on the more treatable causes of vision impairment such as cataract, while the role of vitreoretinal services remain under-recognized.<sup>7,10</sup> Great technological advances in vitreoretinal surgery, including microincisional technology, wide angle microscope systems, and chromovitrectomy, resulted with better postoperative results.<sup>1,2,4,6</sup> As the techniques and equipment have improve and become more available, vitrectomy is more commonly used in complex retinal cases and the indications for vitreoretinal surgery are expanding.<sup>2,4</sup> However, there is a limited number of information on vitreoretinal surgical services in our country and we have presented the first study on this important topic from Bosnia and Herzegovina. The number of vitreoretinal procedures in the world is increasing, as reported in our study. However, the most common indications for vitreoretinal surgery vary among countries (Table 2.).

**Table 2.** Most important indications for vitreoretinal surgery in different countries

Author	Country	Age	Male sex	First most important indication	(%)	Second most important indication	(%)	Third most important indication	(%)
Bialasiewicz et al., 2011.11	Oman	46	63	PDVR	29	Trauma	21	Retinal detachment	14.3
Jackson et al., 2013.8	England	65.1	51.9	Retinal detachment	48.5	Macular surgery	19.4	Diabetes complications	7.3
Teke et al., 2013.4	Turkey	52.6	62.4	Retinal detachment	35.4	Diabetes complications	29.5	Vitreous hemorrhage	5.9
Shuaib & Memon, 2014.10	Nigeria	45.6	77	Retinal detachment	51	Vitreous hemorrhage	21	Tractional retinal detachment	10
Kim et al., 2017.12	South Korea	N/A	52.7	Diabetes complications	31.0	Retinal detachment	16.8	Macular surgery	14.0
Gupta et al., 2017.5	England	59.6	57.3	Retinal detachment	54.8	Macular surgery	11.4	Vitreous hemorrhage	8.9
Neffendorf et al., 2017.13	England	62.3	66.2	Retinal detachment	41.5	Macular surgery	23.3	Vitreous hemorrhage	13.9

Gupta et al., 2018.1	England	59.8	55.9	Retinal detachment	42.8	Macular surgery	18.1	Vitreous hemorrhage	12.6
Meillon et al., 2018.14	France	68	56.6	Macular surgery	45.5	Retinal detachment	30.9	Other	13.3
Loukovaara et al., 2018.6	Finland	65.4	51.5	Macular surgery	39	Retinal detachment	34	Vitreous hemorrhage	7
Fang et al., 2018.15	China	52.9	50.4	Retinal detachment	51.6	Macular surgery	15.0	Vitreous hemorrhage	13.0
Okonkwo et al., 2019.7	Nigeria	47	70.9	Retinal detachment	62	Diabetes complications	10	Trauma	6
Hashimoto et al., 2021.16	Japan	N/A	N/A	Retinal detachment	40.2	Diabetes complications	27.6	Macular surgery	22.2
Present study	Bosnia and Herzegovina	61.3	55.7	Retinal detachment	33	Diabetes complications	32	Complications	11

N/A – not available for analysis, PDVR – proliferative diabetic vitreoretinopathy



**Figure 2.** Temporal changes in indications for vitreoretinal surgery

This study has demonstrated that retinal detachment, although a low public health concern, is the most common indication for vitrectomy.<sup>5,7,8</sup> Ethnic diversity plays an important role in different vitreoretinal indications, where Afro-Caribbean patients have lower rate of retinal detachment, but have a higher rate of macular hole surgery.<sup>5</sup> Advanced diabetic retinopathy is the second important indication for vitrectomy as in other developing countries.<sup>4</sup> Nevertheless both, retinal detachment and diabetes complication present a wide area with a possibility to prevent blindness.<sup>7</sup> Although the number of surgeries performed for macular pathology in our country is increasing, it still remains priority for wealthier nations.<sup>6-8,12</sup> The average age of patients undergoing vitreoretinal surgery significantly varies between the studies, and reflects the difference in most important indications. In this study the average patient age had increased during the study period mostly as a result of increased number of macular surgery cases. However, the number of younger trauma patients had also increased, which to some extent neutralized this increase. Male preponderance in patients requiring vitreoretinal surgery is a universal finding in both population based and hospital based studies. The patients in high income countries are older than in low income countries, mostly due to increased life expectancy and high percentage of patients requiring macular surgery.<sup>6,12</sup> On the other side, vitreoretinal services in low to middle income countries have to overcome high number of younger male patients treated for ocular trauma and complications of diabetes

mellitus.<sup>4</sup> Afro-Caribbean and Asian populations tend to have a higher prevalence and younger onset of diabetic retinopathy.<sup>5</sup> Additionally, inequalities in healthcare access might explain significantly higher number of male patients undergoing vitreoretinal surgery in developing countries.<sup>10</sup> Preoperative VA less than 20/200 was noted in the majority of patients in this study. One of the aggravating factors can be found in the fact that two thirds of patients with retinal detachment needed almost a month from VA deterioration to hospital admission. This essentially shows that late presentation of patients undergoing vitreoretinal surgery in Bosnia and Herzegovina presents a major problem. This coincides with the results of previous reports from low income countries where average time to hospital admission can be as long as 13.5 months.<sup>7</sup> Another important finding in this study is a high percentage of patients treated for diabetes complications, where the vast majority of patients were treated for tractional retinal and proliferative vitreoretinopathy. Preoperative use of anti-VEGF agents can facilitate the treatment of these patients.<sup>4,16,17</sup> However, vast majority of patients in this study did not have any laser pretreatment, which certainly gives space for future preventive activities. Preferences for vitreoretinal procedures in different conditions have significantly changed in the last decade.<sup>1,16,17</sup> Therefore, the prevalence of vitreoretinal disorders plays an important role in accessing the need for vitreoretinal surgeons and future organization of vitreoretinal services.<sup>1,2,8</sup> Our data have shown an increasing incidence of macular surgery which has coincided with improvements in posterior



segment visualization and development of vital dyes.<sup>1,6,7,12,16</sup> Generally, current trend has major implication on the future vitreoretinal surgeons education and training, and particularly suggests the massive use of small gauge surgery and further decrease of scleral buckle surgery.<sup>1,13</sup> Also, the use of silicon oil will depend on the number of complex cases, which could be influenced by adequate activities at the primary level in the future. The strengths of this study include the prospective design and the ability to record all demographic and preoperative details. Limitations of this study include the possibility of under-reporting number of vitreoretinal cases. While UCCT is the only institution authorized and able to provide treatment for vitreoretinal surgery in Tuzla Canton, it is still possible that some patients asked for help in another health institution outside our region. However, all patients with vitreoretinal conditions are directly referred from the primary

level, and UCCT provides free health services for many years, therefore this number should be small and unlikely to affect the overall results of this study.

## CONCLUSION

In conclusion, this study has provided a detailed insight into the epidemiology of patients hospitalized for vitreoretinal surgery in Bosnia and Herzegovina. Special attention should be paid to earlier detection and management of patients with retinal detachment. This study also identified the need for implementation of diabetic retinopathy screening programs in order to identify and treat proliferative disease early. Public patient awareness of symptoms should be raised in order to accelerate primary evaluation and facilitate early vitreoretinal examination.

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