

The etiological factors and variation effects of severe vitreous hemorrhage in Northern China

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中国北部地区严重玻璃体积血的病因及其影响因素分析

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摘要

目的:探讨中国北部地区严重玻璃体积血的病因及其影响因素。

方法:对 2011-01/2014-01 在中国人民解放军火箭军总医院、北京市健宫医院及西安市第四医院因玻璃体积血(玻血)行玻璃体切割手术的患者进行回顾性分析。

结果:1275 例患者(1335 眼)被纳入此研究。其中糖尿病视网膜病变(PDR)、视网膜静脉阻塞(RVO)、视网膜脱离/视网膜裂孔(RD/RH)、外伤、Eales 病、老年性黄斑变性或息肉样脉络膜血管病变(AMD/PCV)所致玻璃体积血的总占比高达 90% 以上。年轻患者最常见玻璃体积血原因为外伤(40%)、PDR(19.5%)和 Eales 病(19.1%);中年患者最常见玻璃体积血原因为 PDR(34.4%)、RVO

(30.8%)及 RD/RH(12.2%);RVO(35.7%)、PDR(26.6%)、RD/RH(14.6%)及 AMD/PCV(8%)则是老年患者玻璃体积血的主要原因。

结论:糖尿病视网膜病变、静脉阻塞及外伤是玻璃体积血最常见原因。不同年龄段中导致玻璃体积血发生的原因各有不同。PDR 及 RVO 易出现复发性玻璃体积血,再次手术可能性大。

关键词:玻璃体积血;病因;复发因素;年龄特征

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Abstract

• **AIMS:** To investigate the etiological factors and various effects of severe vitreous hemorrhage (VH) in Northern China.

• **METHODS:** Files on patients presenting with VH treated with vitrectomy between January 2011 and January 2014 were retrieved from medical records.

• **RESULTS:** A total of 1335 eyes of 1275 patients (735 males, 540 females) presenting with VH were included in this study. Proliferative diabetic retinopathy (PDR), retinal vein occlusion (RVO), either retinal detachment or retinal hole (RD/RH), ocular trauma, Eales disease, and either age-related macular degeneration or polypoidal choroidal vasculopathy (AMD/PCV) constituted the etiology of VH in more than 90% of the patients. The most common causes of VH were ocular trauma (40%), PDR (19.5%), and Eales disease (19.1%) in the youth group, PDR (34.4%), RVO (30.8%), and RD/RH (12.2%) in the middle-aged group, and RVO (35.7%), PDR (26.6%), RD/RH (14.6%), and AMD/PCV (8%) in the elder group.

• **CONCLUSION:** PDR, RVO, and ocular trauma are usually the main causes of VH. Within each group, the most common causes of VH were ocular trauma and Eales disease in the youth group, PDR, RVO, and RD/RH in the middle-aged group, and RVO, PDR, RD/RH, and AMD/PCV in the elder group. In addition, we found that males with ocular trauma are at high risk for VH, PDR and Eales disease often present bilateral VHs, and PDR and RVO have a high risk of recurrence.

• **KEYWORDS:** vitreous hemorrhage; etiology; recurrence factor; age characteristics

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INTRODUCTION

Vitreous hemorrhage (VH) is a common condition that presents with varied clinical manifestations and causes. Symptoms depend on the severity of the VH. Mild hemorrhage causes the sudden onset of floaters and diffuse blurring of vision (although, it may not affect visual acuity), while a dense bleed may result in significant visual loss^[1]. VH is a major concern in that it could delay visual rehabilitation as well as interfere with fundus examinations^[2]. The most common causes, as reported by other researchers, include proliferative diabetic retinopathy (PDR), vitreous detachment, either with or without retinal breaks, and trauma. Less common causes include vascular occlusive disease, retinal arterial macroaneurysm, hemoglobinopathies, age-related macular degeneration (AMD), and intraocular tumors^[3–6]. The etiological factors of VH often vary based on the sample of observation, patient age, geographical location, and race^[6–7].

The aims of our study were to investigate the causes of VH in different age groups and to determine the risk factors for recurrence in Chinese patients with VH in Northern China.

SUBJECTS AND METHODS

Data were retrieved from all patients who were treated for VH with a vitrectomy between January 2011 and January 2014 in three hospitals; the PLA Rocket Force General Hospital, Beijing Jiangong Hospital, and Xi'an No. 4 Hospital. All eyes that presented with a fundus-obscuring VH (defined as vision of 20/400 or worse and requiring a B-scan at presentation) were evaluated. Inclusion criteria were as follows: 1) VH confirmed by ultrasound; 2) early vitrectomies for VH were progressing when the hemorrhaged blood was unabsorbed after 2–3mo. Patients were excluded when their vitreous opacities were caused by a variety of pathological processes that primarily involved other ocular sites. The patients were divided into three groups by age. Per the criteria established by the World Health Organization (WHO) in 2000, patients younger than 45 years old were assigned to the youth group, while patients aged 45–60y were assigned to the middle-aged group, and patients older than 60y were assigned to the elder group. The patients' medical histories were reviewed, and additional information regarding past medical history and family history was obtained from family members. The recorded data included the patients' sex, age at presentation at the hospital, and recurrence situation.

A commercially available statistical software package (SPSS for Windows, version 20.0, SPSS, Inc., Chicago, Illinois, USA) was used to analyze the data. A 1-sample Kolmogorov-Smirnov test was performed to examine whether the samples

were distributed normally. Differences in age, sex, and eyes at presentation were analyzed using the chi-square test. These differences were considered statistically significant, with two-tailed probability levels of less than 0.05%.

RESULTS

A total of 1335 eyes of 1275 patients (735 males, 540 females) with VH were examined in this study, of which 622 were left eyes. There were 319 eyes with VH from patients in 2011, 319 in 2012, 358 in 2013, and 339 in 2014. In total, 29% of the patients had systemic illnesses. Most of the VHs were unilateral (94%). Notably, 32.7% of the patients were diabetic, 47.4% were hypertensive, and 19.5% were both (Table 1). The distribution of VH varied significantly by gender among the groups ($P < 0.001$). Laterality of the affected eye was not significantly different among the groups ($P = 0.442$) (Table 2).

The causes of VH included PDR (28.6% of patients), retinal vein occlusion (RVO) (28%), ocular trauma (13%), either retinal detachment or retinal hole (RD/RH) (12%), Eales disease (5.5%), either AMD or polypoidal choroidal vasculopathy (PCV) (4.5%), Terson syndrome (0.8%), hemangioma (0.8%), uveitis (0.5%), and choroidal melanoma (0.2%). In the youth group, the most common causes of VH were ocular trauma (40%), PDR (19.5%), and Eales disease (19.1%). In the middle-aged group, the most common causes were PDR (34.4%), RVO (30.8%), and RD/RH (12.2%). In the elder group, the most common causes were RVO (35.7%), PDR (26.6%), RD/RH (14.6%), and AMD/PCV (8%) (Figure 1). There were 75 patients (5.6% of the patients in this study) who had bilateral VHs that were caused by PDR (69.3%), Eales disease (13.3%), RD/RH (5.6%), RVO (4.0%), AMD/PCV (2.7%), Terson syndrome (1.33%), trauma (1.33%), and other causes (2.67%). The rate of VH recurrence was 2.4% in our study, and these recurrences were most commonly caused by PDR, RVO, RD/RH, trauma, Eales disease, and AMD/PCV (Figure 2).

DISCUSSION

This study demonstrated that the majority of patients with VH (94%) were unilateral, which agrees with the findings of previous studies. For example, Yeung *et al*^[8] analyzed 32 patients with closed globe injuries and severe VH, of which 99% had unilateral VH. Our study found that bilateral VHs were caused by PDR (68.9%) and Eales disease (30%). Sudhalkar *et al*^[7] reported that vasculitis was the most common cause of spontaneous bilateral VH. Retinal ischemia may be the most important contributing factor to the development of bilateral VHs in eyes with either PDR or vasculitis.

VH secondary to PDR is a cause of severe vision loss in diabetic patients^[9]. PDR accounts for 64% of VH in patients with type 2 diabetes^[10]. Notably, 30%–60% of diabetic patients have DR (diabetic retinopathy), with 3%–10% of

Table 1 The baseline data of patients

Features	2011	2012	2013	2014	Total	<i>P</i> ^a
Number of eyes	319	319	358	339	1335	0.124
Left	148(46.4)	159(49.8)	164(45.8)	151(44.5)	622(46.6)	0.568
Sex						
M	170(53.3)	160(50.2)	203(56.7)	202(50.6)	735(55.1)	0.082
Age (a)						
Youth(≤44y)	70(21.9)	67(21.0)	73(20.4)	62(18.3)	272(20.4)	0.689
Middle-aged(44–59y)	153(48.0)	134(42.0)	142(39.7)	161(47.5)	590(44.2)	0.074
Elder(≥60)	96(30.1)	118(37.0)	143(39.9)	116(34.2)	473(35.4)	0.052
Medical history						
Diabetes	114(35.7)	109(34.2)	106(29.6)	103(30.4)	432(32.3)	0.263
Hypertension	144(45.1)	150(47.0)	169(47.2)	170(50.1)	633(47.4)	0.636

^aUsing the chi-square test; VH: Vitreous hemorrhage.

Table 2 The variation effects of VH in different ages, eyes and sex

Parameters	Youth	Middle-aged	Elder	<i>P</i> ^a
Eyes				
Right	126	265	231	<0.001
Left	146	325	242	
Sex				
Male	206	310	220	0.442
Female	66	280	253	

^aUsing the chi-square test.

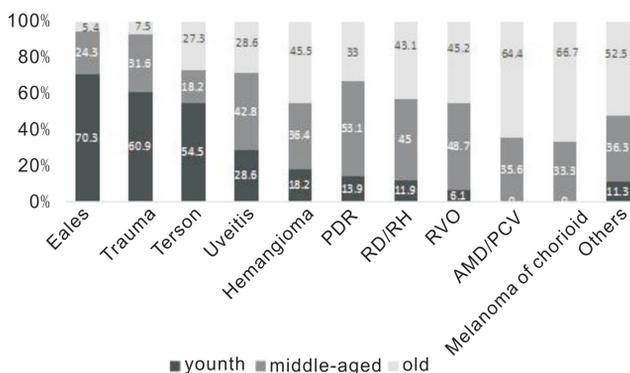


Figure 1 Etiologies of VH in different age groups.

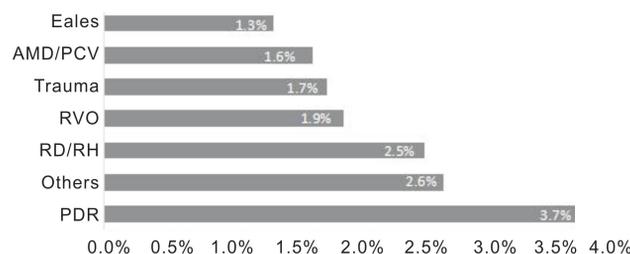


Figure 2 The recurrence factors of VH, PDR and RVO have a high risk of recurrence.

them in the proliferative stage. In addition, 50%–70% of type 2 diabetes cases show DR symptoms after 10y, and 90% show symptoms after 30y^[11–12]. With the increasing number of diabetes cases in China, the incidence of PDR was expected to increase as well. However, our study found no significant growth of PDR cases; the rate of PDR has tended to be either

stable or even lower than anticipated. Although more people now have a deeper understanding of diabetes and its complications and are thus monitoring their diet and lifestyle, the state has advocated for the tertiary prevention of diabetes, even if its spread throughout the population is slow.

The youth group is dominant in Eales disease, trauma, and Terson syndrome; the middle-aged group is dominant in PDR, RVO, and RD/RH; the elder group is dominant in AMC/PCV.

RVO, another common cause of VH (28%), can lead to retinal ischemia, with the subsequent release of proangiogenic factors that result in the formation of new fragile retinal vessels, which are termed “neovascularization”^[5]. The risk factors for RVO are vascular hypertension (59.8%), retinal arteriosclerosis (58%), increased blood beta-lipoprotein (49%) and fibrinogen (21.7%), and high blood viscosity^[13].

Trauma contributed to 13% of the VHs in our study, especially in the youth group and predominantly in males (80.5%). Dana *et al*^[10] found trauma as the cause of VH in 18.3% of patients. Traumatic VH most frequently occurred due to injuries sustained from the use of fireworks^[7]. One possible explanation for this is that men prefer outdoor activities and high-risk jobs more than women, and children are less able to protect themselves^[14].

After 2013, the proportion of VHs due to RD/RH had significantly increased (Figure 3), which may be related to the recent extensive use of vitrectomy in RD/RH treatment and the increasing number of patients treated^[15]. It may also be due to the growing numbers of high myopia patients. Sankaridurg reported that the prevalence of myopia has been steadily rising, with 28% of the global population said to be affected in 2010. That number is expected rise to nearly 50% by 2050^[16].

Less common causes of VH include Eales disease, choroidal melanoma, and Terson syndrome. Eales disease affects young adults who present with ischemic retinal vasculitis. In this instance, the peripheral retina is the most commonly affected

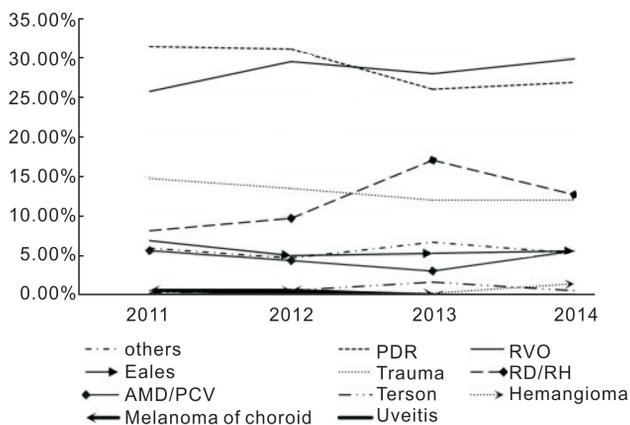


Figure 3 The proportion of causes in different years. PDR, RVO, and ocular trauma are usually the main causes of VH. After 2013, the proportion of VH due to RD/RH had significantly increased.

area, and the progression is often bilateral^[17-18]. AMD/PCV is the leading cause of irreversible blindness in elderly people globally. It is estimated that there will be more Asians with AMD than the rest of the world combined by 2050^[19].

Recurrent post-vitrectomy hemorrhage greatly impedes visual rehabilitation^[2]. Of the studied patients, 2.4% with VH had experienced a recurrence. These recurrences were most commonly caused by PDR, RVO, and RD/RH. Residual epiretinal neovascularization is the most common cause of post-vitrectomy diabetic VH^[20]. Preoperative intravitreal bevacizumab (IVB) might decrease the risk of intraoperative complications, such as hemorrhage, by its antiangiogenic properties^[21]. Rizzo *et al*^[22] performed IVB injections on 11 patients for 5-7d before vitrectomy and showed that regression of active neovascularization made the surgery both quicker and easier to perform.

In conclusion, this study found PDR, RVO, and ocular trauma to be the main causes of VH. Within the three groups, the most common causes of VH were found to be ocular trauma and Eales disease in the youth group, PDR, RVO, and RD/RH in the middle-aged group, and RVO, PDR, RD/RH, and AMD/PCV in the elder group. We also found that males had a higher risk for ocular trauma, PDR and Eales disease cause present bilateral VH, and both PDR and RVO have a high risk of recurrence.

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