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BRIEF COMMUNICATION

Underdiagnosis of risk of glaucoma in patients with retinal vein occlusions

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Studies have identified an association between retinal vein occlusions (RVOs) and glaucoma [1–3]. In this study, we examine the rates of glaucoma-related diagnoses in patients with branch retinal vein occlusions (BRVOs) or central retinal vein occlusions (CRVOs) and compare these rates with a reference group of patients with bilateral dry eye syndrome (DES). We also explore potential underdiagnosis of glaucoma and related conditions in patients with RVOs.

The research followed the tenets of the Declaration of Helsinki and was approved by the institutional review board of the Lahey Hospital & Medical Center (Burlington, Massachusetts, USA). Patients with BRVOs (ICD-10 H34.81) or CRVOs (ICD-10 H34.83) were identified from billing records from 2016 to 2020. These were compared to a reference group of patients with bilateral DES (ICD-10 H04.123), age- and gender-matched 2:1 to the patients with RVOs [4]. Patients were further classified by subtype of glaucoma by ICD-10 codes. In the event where more than one subtype of glaucoma was coded for, the more advanced stage and/or specific subtype was used to classify the patient. Records of patients without known glaucoma-related diagnoses were evaluated for potential underdiagnosis, utilizing criteria of intraocular pressure ≥22 mmHg and/or cup-to-disc ratio (CDR) ≥0.6 and/or CDR difference between eyes ≥0.2 [4].

In total, 643 patients were identified with RVOs, including 376 patients with BRVOs and 278 patients with CRVOs. Age and gender were similar for patients with BRVOs compared with CRVOs (78.6 ± 11.6 years vs. 78.0 ± 13.2 years, $p = 0.564$, and 51% vs. 48% female, $p = 0.511$, respectively). Patients with DES were both younger (68.5 ± 15.9 vs. 78.2 ± 12.3 years, $p < 0.001$) and more likely to be female (70% vs. 50%, $p < 0.001$) compared with the patients with RVOs. The rate of all glaucoma-related diagnoses was significantly greater in BRVO (9.3%) and CRVO (11%) patients compared with the matched reference group (5.4%, $p = 0.005$ and $p < 0.001$, respectively, Table 1). The rate of diagnosed, open-angle glaucoma was significantly greater in patients with BRVOs (4.0%) and CRVOs (4.7%) compared with a reference group (1.7%, $p < 0.001$). By contrast, rate of diagnosis for suspicion for open-angle glaucoma was similar between patients with RVOs compared with the reference group (3.9% vs. 2.9%, $p = 0.235$). However, patients with BRVOs (29%) and CRVOs (33%) were more likely to have clinical findings associated with glaucoma risk compared with the reference group (18%, $p < 0.001$; Table 2). The most common reason for potential underdiagnosis of glaucoma in the present study was a suspicious disc (21% vs. 9%, $p < 0.001$), followed by OHT (15% vs. 10% $p = 0.007$).

Patients with RVOs have higher rates of diagnosed glaucoma when compared with a reference group. By contrast, RVO patients with clinical findings associated with glaucoma risk are often not coded as glaucoma suspects, suggesting a relative underdiagnosis. A delay in the detection of glaucoma could lead to preventable vision loss. Ideally, a patient with any of these risk criteria would be comprehensively evaluated for possible glaucoma. Future studies should assess the extent to which clinical features associated with risk of glaucoma contribute to the development of RVOs [2, 5].

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AUTHOR CONTRIBUTIONS

DSK and TG were responsible for the chart review, extracting and analyzing the data, figure development, and writing of the manuscript. DJR was responsible for the study hypothesis and design, the development of electronic medical record reporting tools, reviewing and analyzing the data, interpreting the results, and writing of the manuscript.

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Table 1. Comparison of the rate of glaucoma by subtype.

	BRVO ($n = 376$)		CRVO ($n = 278$)		All RVO ($n = 643$)		Matched Reference Group ($n = 1286$)		BRVO vs. Reference Group	CRVO vs. Reference Group	All RVO vs. Reference Group
	n	%	*n*	%	*n*	%	*n*	%	*p* value	*p* value	*p* value
Glaucoma-related diagnoses	35	9.3%	31	11.2%	63	9.8%	69	5.4%	**0.005**[a]	**<0.001**[a]	**<0.001**[a]
All open-angle glaucoma	15	4.0%	13	4.7%	27	4.2%	22	1.7%	**0.008**[a]	**0.002**[a]	**0.001**[a]
POAG[b]	10	2.7%	10	3.6%	19	3.0%	12	0.9%	**0.010**[a]	**0.001**[a]	**<0.001**[a]
Pigmentary	0	0.0%	0	0.0%	0	0.0%	2	0.2%	0.444[a]	0.511[a]	0.317[a]
Pseudoexfoliative	1	0.3%	0	0.0%	1	0.2%	5	0.4%	0.727[a]	0.298[a]	0.386[a]
Other open-angle glaucoma	4	1.1%	3	1.1%	6	0.9%	3	0.2%	**0.029**[a]	**<0.001**[a]	**0.033**[a]
Narrow angle glaucoma	0	0.0%	1	0.4%	1	0.2%	0	0.0%	–	**0.031**[a]	0.157[a]
Neovascular glaucoma	1	0.3%	8	2.9%	8	1.2%	6	0.5%	0.597[a]	**<0.001**[a]	0.058[a]
All glaucoma suspects											
Open angle suspects[c]	18	4.8%	8	2.9%	25	3.9%	37	2.9%	0.069[a]	1.000[a]	0.235[a]
Ocular hypertension	2	0.5%	2	0.7%	4	0.6%	3	0.2%	0.352[a]	0.193[a]	0.181[a]
Narrow angle suspects	1	0.3%	1	0.4%	2	0.3%	4	0.3%	0.888[a]	0.896[a]	1.00[a]

RVO retinal vein occlusion, *BRVO* branch retinal vein occlusion, *CRVO* central retinal vein occlusion, *POAG* primary open-angle glaucoma.
[a]Chi-squared test. Significance is marked in bold ($p < 0.05$).
[b]Includes low-tension glaucoma.
[c]Includes pre-glaucoma, borderline glaucoma, and ocular hypertension.

Table 2. Reasons for potential underdiagnosis of glaucoma.

	BRVO ($n = 341$)		CRVO ($n = 247$)		*p* value	All RVO ($n = 580$)		Matched Reference Group ($n = 1217$)		*p* value
	N	%	*n*	%		*n*	%	*n*	%	
CDR ≥ 0.6 or CDR Difference ≥ 0.2	74	21%	54	22%	0.963[a]	124	21%	115	9%	**<0.001**[a]
Max IOP ≥ 22 mmHg	44	13%	45	18%	0.076[a]	87	15%	122	10%	**0.007**[a]
Total[b]	100	29%	82	33%	0.832[a]	178	31%	221	18%	**<0.001**[a]

RVO retinal vein occlusion, *BRVO* branch retinal vein occlusion, *CRVO* central retinal vein occlusion, *CDR* cup-to-disc ratio.
[a]Chi-squared test. Significance is marked in bold.
[b]Patients satisfying both CDR and intraocular pressure criteria are only counted once in the total.

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COMPETING INTERESTS

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ADDITIONAL INFORMATION

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