

The relationship between digital and ocular vasospasm*

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Abstract. The study evaluates whether ocular vasospasms, as determined by visual field tests, are related to a patient history of cold hands and to microscopic findings of the nailfold capillaries. The visual fields of patients with ocular vasospasms may deteriorate after exposing one hand to cold water and may improve after administration of nifedipine. Local cooling of the fingers of patients with vasospastic tendencies results in a significant reduction of capillary blood flow, typically down to a standstill of several seconds. The study reveals a statistically significant relationship between a patient history of cold hands and both the outcome of the perimetric and capillaroscopic tests. Furthermore, the perimetric results correlated significantly with the capillaroscopic results.

Introduction

Some visual field defects are due to insufficient blood supply to the eye and optic nerve. A circulatory insufficiency can be caused by decreased systemic perfusion pressure, by organic obstructive disease of the vessels, but also by vasospasms [6]. The main causes for organic obstruction of the vessel are thrombosis, atherosclerosis, embolization, or exogenous compression. Vasospasm is due to inappropriate constriction of the smooth muscles of the vessels. Such a spasm can involve different organs and may occur at one or several locations simultaneously or successively. Vasospasms are important factors in the pathogenesis of a number of diseases such as migraine, Raynaud's phenomenon, and variant angina. The etiology of the vasospastic syndrome is not yet known and is thought to be multifactorial [6]. Emotional and psychic stress as well as nicotine or cold can provoke a spasm, and the systemic nervous system seems to play an important role in its pathogenesis [1]. We have previously reported that vasospasm can cause disturbances in visual function, which are at least partly reversible [7]. We showed that in such patients who have diffuse or localized visual field defects, visual function deteriorated after immersing one hand in cold water [6]. Oral nifedipine (a calcium channel blocker) improves such visual fields [3]. When specifically asked, many patients reported

having cold hands, and some of them suffered from migraine. The fingers of a number of them turned pale as the hand was immersed in cold water. The biomicroscopic findings of the eyes of these patients were mostly normal and their retinal arteries were either normal or only slightly constricted. The optic nerve head was normal in some patients, pale in others, and some had cupping [4]. The diagnosis of digital vasospasm was confirmed by a nailfold capillaroscopic cooling test [8]. Ocular vasospastic symptoms seemed in individual cases to be combined with peripheral vasospasm.

The purpose of this study was therefore to determine whether the ocular vasospasms, as diagnosed by visual field tests, are related to the patient's history of cold hands and to the microscopic findings of the nailfold capillaries. Furthermore, the effects of nifedipine on visual function and on the cold reaction of the nailfold capillaries were compared.

Subjects and methods

The findings on 30 patients (19 women and 11 men) were analyzed. The age ranged from 16 to 82 years (mean age 48 ± 25 years). Patients with unexplained visual field defects and with a hint of a vasospastic syndrome were included. The results of ophthalmological examinations were normal with the exception of pale or cupped optic nerve heads in some cases [4]. Patients with an intraocular pressure above 21 mm Hg, as measured with a diurnal tension curve, were excluded.

The two following tests were carried out: (a) microscopy of the nailfold capillaries, including local cold exposure test; (b) visual field tests on the Octopus automated perimeter. In addition, we also took a detailed patient history.

Microscopy of the nailfold capillaries was done under normal conditions and after warming and local cooling of one finger. Local cooling in patients with vasospastic tendencies results in a significant reduction in capillary blood flow, typically down to a standstill of several seconds. This examination was repeated 30 min after the oral ingestion of 10–20 mg nifedipine. On another day, the visual fields were measured with the program G1 [5] on the Octopus automated perimeter. Perimetry was repeated after the patient had immersed one hand in cold water for 15 min [6]. The cooling was continued during the visual field examination. Then the perimetry was repeated 30 min after the intake of 10–20 mg nifedipine (the exact dosage depending

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on the weight of the patient). The measured mean sensitivity (MS) [2] was used for statistical analysis. An improvement was diagnosed when the MS increased and deterioration was accepted when the MS decreased. Exactly the same MS was not strictly reproducible. Finally, the patients were asked about the thermal sensations of their hands in daily life. The history was marked as positive if the patients reported that they had colder hands more often than other people and if this occurred even in the summer.

Results

Twenty of the 30 patients had a history of frequently cold hands. Seventeen of the 30 patients had a blood-flow stop in the fingers after cooling, as measured with the nailfold capillaroscopy. Nine of 23 patients had improvement in their visual field, while 12 showed deterioration after cooling one hand. In 7 patients the visual field cold test was not carried out.

Relationship between the patient history and the nailfold capillaroscopic cooling test

Of the 20 patients with a positive history of cold hands, the capillaroscopic cooling test for 15 was positive (blood-flow stop of at least 12 s during the cold test), and for 5 negative. One of latter has multiple sclerosis. Only 2 of the 10 patients without a history of cold hands had a blood-flow stop, while 8 did not. One woman who gave a negative history but showed a blood-flow stop indicated that other people had noticed that she had cold hands. The mean age in the group with a positive history was 40 ± 14 years, while in the group with a negative history the mean age was 57 ± 13 years. The correlation of the history of cold hands and the outcome of capillaroscopic cooling test was statistically significant on the basis of a chi²-test ($P < 0.01$; Table 1)

Relationship between the patient history and the visual field cold water test

Eleven of 15 patients with a history of cold hands had deterioration of the visual fields (increased MD) after one hand was cooled, whereas the other 4 showed no deterioration. One patient in the latter group was the patient who had multiple sclerosis.

Of 8 patients with negative history, 5 showed an improved visual field and the other 3 deterioration after provocation with cold water. One of the 3 patients with a negative history but deterioration of the visual field was the one in whom other people noticed her cold hands. Another elderly woman in this group indicated that she often had cold hands before menopause. The relationship between the patient's history of cold hands and the behavior of the visual field to cold testing was statistically significant on the basis of chi²-test ($P < 0.025$; Table 2).

Relationship between the nailfold capillaroscopic cooling test and the visual field cold water test

Ten of the 13 patients with cessation of blood flow in the fingers, as measured with the capillaroscopic cooling test, showed a marked deterioration of the visual field (increase of MD) following cold water exposure. Two of the 3 patients who showed no change were 16 and 17 years old.

Table 1. Correlation between microscopic of the capillaries and a patient history of cold hands

		Microscopy of the capillaries			
		Positive	Negative	Total	
Patient history of cold hands	+	15 (75%)	5 (25%)	20	$P < 0.01$ (chi ² -test)
	-	2 (20%)	8 (80%)	10	
Total		17	13	30	

+ History of cold hands; - no history of cold hands; positive, blood flow cessation on microscopy; negative, no flow cessation on microscopy

Table 2. Correlation between the outcome in the visual field with cold test and a patient history of cold hands

		Negative	Positive	Total	
Patient History	+	4 (27%)	11 (73%)	15	$P < 0.025$ (chi ² -test)
	-	5 (63%)	3 (37%)	8	
Total		9	14	23	

+ History of cold hands; - no history of cold hands; negative, improved or unchanged visual field; positive, deterioration of the visual field

Table 3. Correlation between the behavior of the visual field during cold water test and the capillaroscopic cooling test

		Negative	Positive	Total	
Blood flow stop in nailfold capillaries	<i>p</i>	3 (23%)	10 (77%)	13	$P < 0.025$ (chi ² -test)
	<i>n</i>	6 (60%)	4 (40%)	10	
Total		9	14	23	

p, Flow stop; *n*, no flow stop; negative, improved or unchanged visual field; positive, deterioration of the visual field

Six of the 10 patients who showed no cessation of flow also showed an improvement in the visual fields subsequent to cold water exposure, but the other 4 did not. The woman who had had cold hands before menopause was one of them. The relationship between the microscopical findings on the nailfold capillaries and the behavior of the visual field after the cold water test was again statistically significant on the basis of a chi²-test ($P < 0.025$; Table 3).

Discussion

The visual fields of patients with ocular vasospasms may deteriorate after exposing one hand to cold water and improve after the intake of nifedipine [3, 6]. In our present study, the vasospasms in the fingers were statistically significantly related to vasospasms in the eye, as expressed by visual field changes, so that patients with a tendency to produce vasospasms in the fingers, after exposure to cold,

had a tendency to react with vasospasm in the eyes. The visual field defects and cold hands may thus be symptoms of the same underlying disorder, namely, the provocation of vasospasms by cold. Our results suggest that vasospasms are not only present in Raynaud's phenomenon, migraine and angina, but may also be responsible for disturbance of visual function and possibly also for development of low-tension glaucoma [4]. The co-incidence in the majority of patients of vasospasms in the nailfold capillaries and deterioration of visual fields following a cold water test points to vasospasms having multiple expression. It is interesting from a clinical point of view that a patient history of cold hands and feet allows a fairly good prediction of visual field changes and changes in the circulation in the fingers following the cold water test. It is thus important for the clinician to ask patients presenting with unexplained visual field defects about a possible history of cold hands. Most of the patients with a history of cold hands showed deterioration of the visual fields and blood-flow cessation in the fingers following cooling. On the other hand, few patients without a history of cold hands showed a tendency toward vasospasms either in the eyes or in the fingers. Since vasospasms can occur in single or multiple locations [6], vasospasm in the fingers may not necessarily indicate vasospasm in the eyes or vice versa. Furthermore, many other diseases may influence the history of cold hands, such as multiple sclerosis or connective tissue disease.

The mean age of patients with vasospasms was lower than patients without vasospasm. It is possible that a vasospastic tendency decreases with age. It is at present unknown where vasospasms occur in the eye. We assume in the choroid. The choroidal vessels as well as the vessels in the fingers are embryologically derived from the mesoderm. The primary purpose of both is the regulation of temperature, and both systems are autonomically innervated by the sympathetic nervous system. Patients with a predisposition toward vasospasms may therefore react with vasospasms in the eyes or fingers or both. As a result of

our findings, we would like to emphasize that vasospasm should be included in the list of factors producing visual field defects. It is worthwhile asking such patients about a history of cold hands. The indication of cold hands is especially significant if the patient has cold extremities even in the summer. Further diagnostic tests may then confirm the diagnosis of ocular vasospasms. The long-term treatment of such patients is not yet well established. The effects of nifedipine or other calcium-entry blockers for long-term treatment are presently under investigation [3].

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