COLD-INDUCED VASOSPASM AFTER DIGITAL REPLANTATION DOES NOT IMPROVE WITH TIME

A 12-year prospective study

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The incidence of cold-induced vasospasm after hand injuries has been reported to be as high as 100%, following replanted digital amputations. The exact cause of this problem is obscure, no specific treatment is available and little is known about the long-term prognosis. Further knowledge is therefore needed in order to advise patients concerning future job potential at an early stage. In a previous paper we evaluated the incidence and severity of cold intolerance 2 years after digital replantation. The incidence of cold-induced vasospasm then was high as well as the discomfort experienced by the patients. We carried out a follow-up of patients previously examined 10 years ago. Our results show that cold induced vasospasm in replanted digits does not improve with time. Patients with moderate symptoms may perceive improvement, probably due to a change of habits. Patients with severe problems did not experience improvement and should be given early advice to seek work in warm surroundings to reduce the discomfort.

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Cold-induced pain in replanted digits is one of the major problems in otherwise well-rehabilitated hands. The incidence of secondary Raynaud's phenomenon following hand injuries has been reported to be as high as 100% after replanted digital amputations, with an unknown degree of improvement in time (Kleinert et al, 1980; Scott et al, 1981; Kay, 1985). The exact cause of this problem is obscure, no specific treatment is available, and little is known about the long-term prognosis. Further knowledge is therefore needed in order to advise patients concerning future job potential at an early stage. In a previous paper (Nylander et al, 1987) we evaluated the incidence and severity of cold-intolerance 2 years after digital replantation. The incidence of cold-induced vasospasm was high, and so was the discomfort experienced by the patients. It is generally believed that cold induced vasospasm improves with time (Glickman and MacKinnon, 1990) although no prospective studies on this matter have previously been performed. With the purpose of shedding some light on this subject we followed up patients previously examined 10 years ago (Nylander et al, 1987).

MATERIAL AND METHODS

Patients with digital replantations previously evaluated 10 years ago were included in this study. All eight patients who participated in the previous study (Nylander et al, 1987) attended for follow-up.

Before the cold stress test, the patients were asked to complete a questionnaire regarding the degree (much, some, or none) of cold-induced discomfort experienced indoors, outdoors, in summer, and in winter. They were also asked if they had changed occupation or leisure activities due to the accident.

The peripheral circulation was examined in the replanted finger by measuring the digital systolic pressure before and after cooling. Before measurement, the patient rested for 15 minutes at room temperature (20°–22°C). The blood pressure was measured with an occluding cuff placed around the base of the finger and a strain gauge around the distal part of the phalanx (Nielsen and Lassen, 1977; Nylander et al, 1987). The finger was cooled with a double inlet plastic cuff (Medimatic, Denmark). Digital systolic pressure (DSP) was first measured after 5 minutes of perfusion with water at 30°C, with arterial occlusion on the proximal phalanx, and then after 5 minutes cooling with water at 10°C, also during occlusion.

The relative digital blood pressure reduction as a percentage during cooling at 10°C ($\Delta DSP\%_{10°C}$) was calculated as:

$$\Delta DSP\%_{10°C} = 100 \times (DSP_{30°C} - DSP_{10°C})/DSP_{10°C}.$$

A decrease of 20% or more was considered to be pathological vasospasm (Nielsen et al, 1981; Nylander et al, 1987).

RESULTS

Questionnaire

Four patients described unchanged severe cold-induced pain outdoors in winter, one had some pain, and three said that they had no pain (Table 1).

Plethysmographic evaluation

Digital systolic pressures at 30°C and during 10°C cooling of the replanted fingers 2 years after replantation and again 10 years later are shown in Table 2. Statistical evaluation of the paired results shows no significant

Table 1—Number of patients with subjective cold induced pain outdoor in winter

	Much	*Some*	*None*
2 years after replant	4	3	1
12 years after replant	4	1	3

Table 2—Values of digital systolic pressure (DSP) at 30°C and at 10°C. Values were obtained 2 and 12 years after replantation

Patients	*2 years*		*12 years*	
	DSP 30°C	*DSP 10°C*	*DSP 30°C*	*DSP 10°C*
1	80	40	100	60
2	95	70	100	70
3	80	25	90	20
4	100	105	100	100
5	115	5	130	40
6	110	10	110	10
7	115	60	110	60
8	130	50	130	0

difference between the groups (significance level $P \leqslant 0.05$, Wilcoxon paired test).

Corresponding $\Delta DSP\%_{10°C}$ measurements are shown in Figure 1. All but one patient showed pathological measurements ($\Delta DSP\%_{10°C} \geqslant 20\%$). The patient with the normal measurement during cooling also exhibited a normal measurement at the previous evaluation. Though minor changes are seen between values at the 2- and 12-year follow-ups, these were not significant (significance level $P \leqslant 0.05$, Wilcoxon paired test).

DISCUSSION

Our results show that some patients who had subjectively experienced moderate discomfort initially were now suffering less than previously (Table 1). However, when subjected to a standardized cold stress, the cold induced vasospasm was pathological, as it was 10 years previously (Fig 1).

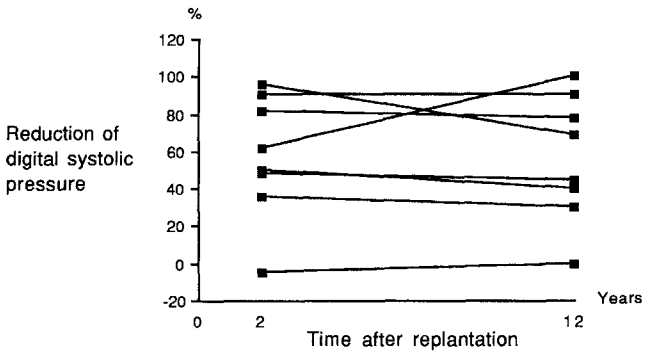

Fig 1 Reduction of finger systolic pressure at 10°C water cooling in % (ΔDSP%) of pressure at 30°C. Corresponding measurements 2 and 12 years after replantation are shown.

Cold sensitivity and cold-induced vasospasm are common symptoms following injuries to the hand, and may be the main cause of discomfort of an otherwise well-rehabilitated hand. This disabling response to cold is especially a problem after amputations and may be the main problem after a digital replantation (Nyström et al, 1991). Many questions remain unanswered concerning the physiological background to the "icy-cold feeling which can progress to pain", triggered by the patient's exposure to low temperatures (Engkvist et al, 1985). Several studies of patients after digital replantation have shown a correlation between cold intolerance and pathological reactivity of the digital arteries to cold (Gelberman et al, 1978; Koman and Nunley, 1986; Nylander et al, 1987). The cold intolerance phenomenon is not only found among digital amputees who have undergone replantation, but also after conservative treatment (Backman et al, 1991). It is not known if the condition is an immediate consequence of a pathological arterial reaction to cold, or if cold intolerance and cold-related vasospasm are caused by a third factor such as nerve injury (Morrison et al, 1978; Gelberman et al, 1978).

As this discomfort may prevent the patient from working in cold environments, further knowledge of the long-term perspective is desirable. The outcome 12 years after digital replantation and 10 years after the previous evaluation gives a uniform answer, despite the small number of patients in this study. Patients with moderate discomfort may experience some long-term improvement. This subjective improvement may be due to changes in work and leisure habits, as seen for the two patients in our study who experienced improvement, who for other reasons changed to indoor jobs. The plethysmographic outcome was unchanged for these patients.

We therefore conclude that cold-induced vasospasm in replanted digits does not improve with time. Patients with moderate symptoms may perceive an improvement with time, probably due to a change of habits. Patients with severe problems did not experience improvement and should thus be advised at an early stage to seek work in warm surroundings.

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