clear; although symptoms were dramatically reduced, virus infection and seroconversion were not completely prevented. Possibly interferon only delayed the onset of the inevitable cold, but the limited evidence suggests that late colds were extremely mild. Although volunteers may have been susceptible to and caught their flatmates' colds when they finished treatment, virus isolation studies seem to show that virus persisted in the nose during treatment. Theoretically, with continued interferon treatment, virus replication would be reduced. It would then be necessary to continue treatment only until antibodies were formed to prevent clinical colds completely. An antiviral agent used widely in the prophylaxis of minor upper respiratory disease would clearly have an advantage if it allowed subclinical infection and an immune response. Furthermore, if interferon reduced absolute virus shedding and nasal secretions, transmission of colds could also be reduced.

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Requests for reprints should be addressed to Dr G M Scott, Clinical Research Centre, Watford Road, Middlesex HA1 3UJ.

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After-exercise thermography and prediction of deep vein thrombosis

A LINDHAGEN, D BERGQVIST, T HALLBÖÖK, B LINDROTH

Abstract

A total of 112 patients participated in a prospective study of after-exercise thermography as a screening method for predicting risk of postoperative deep venous thrombosis. The fibrinogen-uptake test was used to detect thrombosis after elective surgery. The incidence of the complication showed no significant difference between patients who had had positive and those who had had negative thermograms.

Thermography does not seem to be useful for predicting risk of postoperative thrombosis.

Introduction

After-exercise thermography shows a highly distinctive pattern in some patients. This pattern has been claimed to indicate deep venous insufficiency.¹ In a prospective study of 109 patients² the pattern was associated with high risk of postoperative

thrombosis as detected by the fibrinogen-uptake test. As post-operative thrombosis is a multifactorial condition, devising a simple test to predict this risk presents great problems. We therefore conducted a prospective study to see whether after-exercise thermography in our hands could detect high-risk patients.

Patients and methods

We studied 112 patients (63 men, 49 women) aged 51-86 years (mean age 67.6 years). All were participating in a study of prophylaxis against postoperative thromboembolism. Dextran 70 was given to 53 patients and a combination of dextran 70 and dihydroergotamine to 59 patients. Elective hip replacement was performed in 65 cases and abdominal surgery in 47.

After-exercise thermography was performed preoperatively with the AGA 680 Medical System. A resting thermogram was recorded with the patient's legs 15-20° above heart level after the unclothed legs had been exposed to room temperature for 10-15 minutes. The patient was then instructed to walk around the room or do knee-bends for two minutes. As soon as possible after the exercise a second thermogram was recorded with the patient positioned as before. A network of linear hot spots crossing the anterior tibia, not present on the initial thermogram, was regarded as positive.³

The ¹²⁵I-fibrinogen-uptake test was used to detect postoperative thrombosis. The test was performed as described by Kakkar *et al*,⁴ but with slight modifications.⁴ Measured activity was correlated with the precordial activity. An increase in uptake of 20% or more as compared with adjacent points on two consecutive measurements was accepted as the criterion for deep venous thrombosis. The thermo-

Kärnsjukhuset S-541 85 Skövde, Sweden

A LINDHAGEN, MD, department of surgery

T HALLBÖÖK, MD, department of surgery

B LINDROTH, MD, department of radiology

Allmänna Sjukhuset S-214 01 Malmö, Sweden

D BERGQVIST, MD, department of surgery

grams were interpreted by one of us (BL) before knowing the results of the fibrinogen-uptake test.

Results

After-exercise thermography gave positive results in 94 legs in 58 patients. Thus 36 patients had positive results in both legs. The fibrinogen-uptake test detected thrombosis in 27 legs in 26 patients; hence one patient had thrombosis in both legs. All thrombi were below knee level. Tables I and II summarise these results. The risk of developing thrombosis detectable by the fibrinogen-uptake test was 12.8% (12/94) in legs yielding positive thermograms and 11.5% (15/130) in legs yielding negative thermograms. The difference was not statistically significant.

TABLE I—Results of after-exercise thermography and fibrinogen-uptake test. (Figures are numbers of legs)

Result of fibrinogen-uptake test	Result of after-exercise thermography		Total
	Positive	Negative	
Positive	12	15	27
Negative	82	115	197
Total	94	130	224

TABLE II—Results of after-exercise thermography and fibrinogen-uptake test. (Figures are numbers of patients)

Result of fibrinogen-uptake test	Result of after-exercise thermography			Total
	Positive		Negative	
	Unilateral	Bilateral		
Positive	4	10	12	26
Negative	18	26	42	86
Total	22	36	54	112

Positive after-exercise thermograms from one or both legs were associated with a 24.1% (14/58) risk of postoperative thrombosis, as compared with a 22.2% risk (12/54) when both thermograms had been negative. The corresponding figures for bilaterally positive and unilaterally positive thermograms were 27.8% and 18.2% (table III). None of the differences was statistically significant.

TABLE III—Incidences of postoperative deep vein thrombosis in patients with bilaterally negative, unilaterally positive, and bilaterally positive after-exercise thermography

No (%) of patients	Result of after-exercise thermography		
	Bilaterally negative	Unilaterally positive	Bilaterally positive
	54 (22.2)	22 (18.2)	36 (27.8)

As expected, the incidence of thrombosis as detected by the fibrinogen-uptake test was higher in the patients who had undergone hip surgery than in the group given abdominal operations (33.8% and 8.8%). There was no significant difference in mean age (67.8 and 67.2 years) or sex ratio between patients who had had positive and negative thermograms. The type of thrombosis prophylaxis and type of operation did not significantly influence the incidence of thrombosis in relation to the result of after-exercise thermography (table IV).

TABLE IV—Incidence of thrombosis as detected by fibrinogen-uptake test in relation to result of after-exercise thermography, type of thrombosis prophylaxis and operation. Results expressed as number (%) of patients

	Result of after-exercise thermography	
	Positive	Negative
Prophylaxis:		
Dextran	4/25 (16)	5/28 (18)
Dextran + dihydroergotamine	10/33 (30)	7/26 (27)
Type of operation:		
Abdominal	3/24 (13)	1/23 (4)
Hip	11/34 (32)	11/31 (35)

Discussion

Deep vein thrombosis is one of the commonest and most important complications of surgery. Hence much effort has been aimed at finding a test that will detect patients at high risk. Most of this work has been directed towards disclosing changes in the coagulatory system. The techniques, however, are complex and expensive and therefore unsuited to routine practice. In 1978 Henderson *et al.*² reported that a characteristic pattern in thermograms made after exercise could help to predict the risk of postoperative thrombosis. Using the fibrinogen-uptake test they found thrombosis after abdominal surgery in 11% of patients who had had bilaterally negative thermograms, 63% of those who had had unilaterally positive thermograms, and 92% of patients who had had bilaterally positive thermograms. After elective hip operations the corresponding figures were 30%, 56%, 75%. Statistically the results were highly significant.

We failed to reproduce these results, though our criterion for a positive thermogram was that used by Henderson *et al.*² The pattern in a positive thermogram is characteristic, but there are borderline cases in which interpretation is difficult, especially if the patient has varicose veins. The true nature of the changes causing the characteristic pattern is still obscure. In another study (unpublished observations) our group was unable to correlate the pattern with deep venous insufficiency as measured from ambulatory venous pressure or by plethysmography.

The patients in our series were somewhat different from those described by Henderson *et al.*² Our patients were older. Also they had received prophylaxis against postoperative thrombosis. Though this prophylaxis may have influenced the results, it seems improbable that the thromboses so prevented were those that might be predicted by after-exercise thermography.

In conclusion, we were unable to show that a positive after-exercise thermogram is of value for predicting postoperative thrombosis as detected by the fibrinogen-uptake test.

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