PAPERS AND ORIGINALS

Is the postphlebitic leg always postphlebitic? Relation between phlebographic appearances of deep-vein thrombosis and late sequelae

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Summary and conclusions

One hundred and thirty legs of 67 patients were examined 5-10 years after the patient had suffered a phlebographically proved deep-vein thrombosis. Forty-seven of the limbs were normal at the time of the phlebogram, 83 contained thrombus. There was little correlation between the phlebographic severity of the thrombus and the late symptoms and signs: 32% of the legs with no thrombosis had symptoms, while 33% of the legs which had suffered severe thrombosis had no symptoms. Postphlebitic symptoms were more common in legs with aging thrombus at the time of phlebography, but upper limit of the thrombus, the age of the patient, and preexisting symptoms did not affect the incidence of late sequelae.

The development of a "postphlebitic leg" does not depend solely on the extent of the initial thrombosis and can apparently develop in the absence of thrombosis.

Introduction

Most clinicians describe a leg which contains varicose veins, mild oedema, skin pigmentation, eczema, and liposclerosis or ulceration in the gaiter area as a "postphlebitic leg." We have recently documented the serious economic and social consequences of a severe postphlebitic syndrome.[1] We described a highly selected group of patients with the worst form of chronic venous disease but gave no indication of the overall incidence of such severe disease after a deep-vein thrombosis. The true incidence of the postphlebitic syndrome cannot be assessed from a retrospective analysis of the history because, although some patients will give a definite history of a venous thrombosis, most do not recollect such an event. This is usually explained by quoting the well-established fact that only 20% to 30% of deep-vein thromboses cause physical signs. But this is not an acceptable explanation. Even after a definite major thrombosis the development of postphlebitic sequelae is both variable and unpredictable. Indeed, it was our inability to tell patients what might happen to their legs after a thrombosis that stimulated us to perform the present study to see whether there is the close correlation between the phlebographic severity of the thrombosis and the state of the leg five to 10 years later that is implied by the term "postphlebitic leg."

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Patients and methods

ASSESSMENT OF PHLEBOGRAM

Bilateral ascending phlebograms had been performed on all patients at the time of the thrombosis using the technique described by Lea Thomas[2] for the purpose of diagnosis and management. Eighty consecutive phlebograms, known to show a fresh, acute, deep-vein thrombosis in one or both legs, from a variety of medical and surgical patients were drawn from our files of 1967 to 1972. The phlebograms had been performed to investigate either leg symptoms or the source of pulmonary emboli, and were accepted only if the patient had had no treatment other than anticoagulation, no malignant disease, and no clinical evidence of a further thrombosis. Three features of the thrombus were assessed: its site, its size and adherence, and its age. These features were scored with the score weighted against the more extensive adherent thrombus because this variety is generally considered to be the more severe and likely to cause more sequelae.

Site—The veins were divided into three anatomical segments: the calf and popliteal vein below the knee joint; the popliteal and superficial femoral veins between the knee joint and the entrance of the profunda vein; and the common femoral and iliac veins. Each segment was scored separately.

Size and nature of the thrombus—Three varieties of thrombus were recognised: small (shorter than 2 cm) non-adherent thrombi in valve cusps, large non-adherent thrombi, and occlusive adherent thrombi. This classification could not be used for calf thrombus, which was simply divided into two grades—thrombus in one stem vein or muscle

sinusoid, and thrombus in more than one stem vein or sinusoid. The scoring was as follows (fig 1): Thrombus in one deep calf stem or muscle vein—1 point; thrombus in two or more stem or muscle veins—3 points; a small valve cusp thrombus, not longer than 2 cm, in a thigh vein—1 point; a large non-adherent thrombus in a thigh vein—2 points; an adherent occluding thrombus in a thigh vein—3 points. The same type of scoring was used for the pelvic veins as the thigh veins except that a large non-occluding thrombus in the pelvis scored 3 points, and an occluding thrombus scored 4. Thus a patient with a totally occluding iliac-femoral-calf vein thrombosis scored 4+3+3=10, whereas a minor calf thrombosis scored 1. The phlebographs were assessed by MLT and NLB without knowledge of the clinical state of the legs. To simplify some of the analyses the thrombosis score was sometimes divided into three classes: none or mild, 0-3; moderate, 4-6; and severe, 7-10.

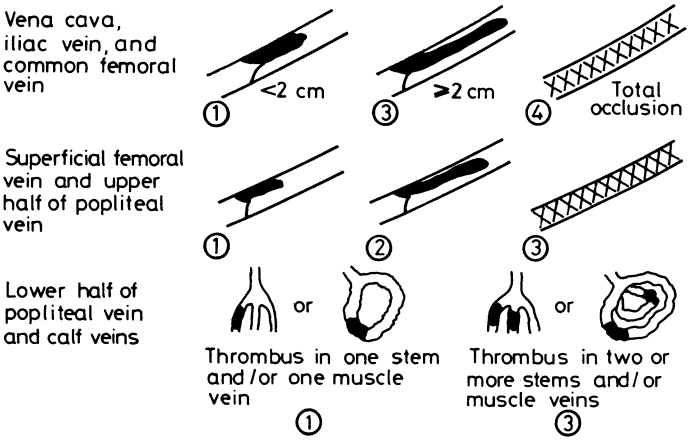

FIG 1—System of scoring based on the site, size, and adherence of thrombus. Numbers in circles are scores. Maximum score for an adherent iliac-femoral-calf thrombosis was 10.

Age—The age of the thrombus was assessed from the degree of retraction, surface irregularity, and radiodensity as described by Lea Thomas and McAllister[3] and assigned to one of three groups, 1-6 days, 7-14 days, and more than 14 days. The phlebographic assessment of thrombus age is mainly subjective but it was done by the same two observers on every occasion and they took no notice of the clinical history when making the assessment. When a phlebogram showed thrombus of varying age we gave an age corresponding to that of the majority of the visible thrombus.

CLINICAL ASSESSMENT

All the patients were interviewed by one of us (GC), who had no knowledge of the phlebographic assessment. Symptoms and signs were scored as follows: aches and pains, and varicose veins—1 each; swelling above the ankle, skin pigmentation, and ankle "flare"—2 each; venous claudication—3; lipodermato-sclerosis—4; and ulceration—5. A leg with all the listed symptoms and signs would have scored 20 points but the maximum score achieved was 15, as venous claudication was uncommon and most badly affected legs had lipo-sclerosis or ulceration but rarely both. The symptoms and signs score was sometimes simplified into three groups: none or mild 0-3; moderate, 4-9; and severe, 10-15. The patient was also questioned, and the notes examined, for evidence of symptoms and signs before the thrombosis.

Results and comment

Sixty-seven patients agreed to attend for examination and assessment. Their mean age was 51·7 years; the 38 men had a mean age of 52·4 years; and the 29 women a mean age of 50·8 years. The mean interval between their thrombosis and follow-up examination was 6·4 years (range 5-10 years).

Bilateral phlebograms had been performed on 63 patients and unilateral phlebograms on 4, giving 130 legs for study. Eighty-three of the phlebograms showed a deep-vein thrombosis, but 47 showed no thrombus. This group of 47 legs, the normal leg of a bilateral phlebogram, formed an important control group. Among the 83 legs with thrombosis, 43 were in men (mean age 52·4 years, mean follow-up 6·5 years) and 38 were in women (mean age 50·8 years, mean follow-up period 6·3 years).

Sixty-seven of the 83 legs with thrombosis had caused no symptoms before the thrombosis, while 16 legs had caused mild symptoms, usually aching pains and occasional swelling with a mean symptom score of 1·4. Thus before the thrombosis most of the legs that thrombosed and all of the legs that did not thrombose were clinically normal.

Initial treatment—The only treatment given after the thrombosis to all the patients studied was a course of anticoagulants—heparin for three to seven days, followed by warfarin for three to six months—and good elastic stockings. Most of the patients with no swelling of the leg stopped wearing their stockings after three months, while those with symptoms were still using them at the time of the follow-up examination.

Relation between symptom score and phlebogram score—Fig 2 plots the symptom score against the phlebogram score of all 130 legs. The dotted line is a standard regression analysis. Although its p value was 0·001, the r value was 0·31, and there was little relation between the two scores. The p value was heavily affected by the large numbers of patients with low scores in both assessments. Of particular interest, and unexpected, were the large number of patients with no symptoms after a major thrombosis and the number of patients who had severe symptoms after a minor or moderate thrombosis. As the inclusion of legs without thrombosis might have biased the analysis, a further correlation was performed with them excluded. The regression coefficient between the symptom score and phlebograph score of the 83 legs that had a definite thrombosis was 0·24, p=0·05. The lack of correlation between the extent of the thrombosis and the symptoms was still more apparent, the variations of the phlebographic score explaining only 9·6% ($100\times(0\cdot31)^2$) and 5·8% ($100\times(0\cdot24)^2$) respectively of the variations in the symptom score. Because the method of scoring was imprecise the scores were probably unworthy of such sophisticated analysis. Consequently they were re-examined after being simplified into three grades—none or mild, moderate, and severe (table I). Again the lack of correlation between the phlebographic assessment and the late symptoms and signs was evident. For example seven of the 15 patients who had had severe thrombosis developed no or only mild symptoms and only three of the nine patients with severe symptoms had had a severe thrombosis. The per-

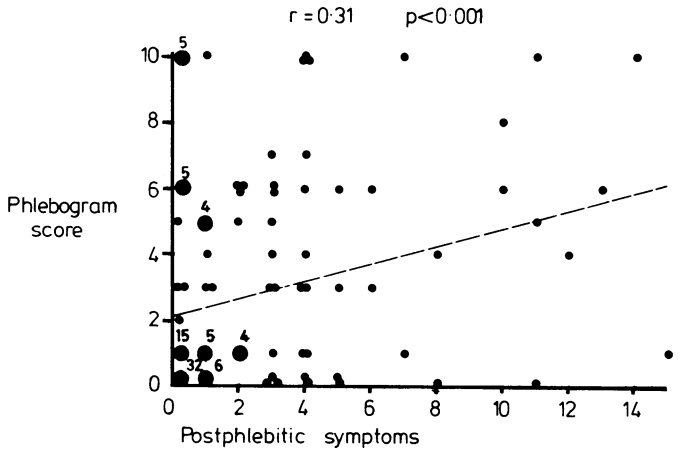

FIG 2—Regression analysis of relation between symptom score and phlebogram score of all 130 legs.

TABLE I—*Relation between severity of thrombosis and incidence of postphlebitic sequelae at 6·4 years. Results are numbers (percentages) of legs*

Severity of thrombosis	Incidence of symptoms			
	None	Mild (1-3)	Moderate (4-9)	Severe (10-15)
No thrombosis	32 (68)	9 (19)	5 (11)	1 (2)
Mild (1-3)	18 (45)	14 (35)	7 (17)	1 (3)
Moderate (4-6)	6 (21)	13 (46)	5 (19)	4 (14)
Severe (7-10)	5 (33)	2 (14)	5 (33)	3 (20)

centages give an indication of the likelihood of developing a postphlebitic leg after a thrombosis and in legs that did not have a thrombosis. Only 20% of legs with severe thrombosis had severe postphlebitic symptoms 5-10 years later, while 2% of legs with no phlebographic evidence of thrombosis developed severe postphlebitic symptoms when their companion leg had had a thrombosis; in fact 32% of apparently normal legs developed some symptoms when the other leg had suffered a thrombosis.

Symptoms after an iliofemoral thrombosis—Twelve legs had a total calf, femoral, and iliac vein occlusion. Such an extensive thrombosis might have been expected to cause severe post-thrombotic symptoms in every case. Table II shows the incidence of symptoms in these legs and in the 47 that showed no thrombosis. Although the incidence of severe symptoms was greater in the legs with thrombosis there was not the mirror image incidence that might have been expected when comparing two such extremes. Half the patients with an iliofemoral thrombosis had no or only mild symptoms at an average follow-up time of 6·6 years, and the average symptom score of the other six patients at an average follow-up time of seven years was only 7—in the moderate symptom range. This group highlights the unpredictability of postphlebitic symptoms. It is not correct to assume that every patient with a total axial limb vein thrombosis will develop severe postphlebitic symptoms six years later; half will have a near normal leg.

TABLE II—*Incidence of postphlebitic sequelae after an iliofemoral thrombosis compared with "control" legs. Results are numbers (percentages) of legs*

	Incidence of symptoms			
	None	Mild (1-3)	Moderate (4-9)	Severe (10-15)
Iliofemoral thrombosis (12 legs)	5 (42)	1 (8)	4 (34)	2 (16)
No thrombosis (47 legs) ..	32 (68)	9 (19)	5 (11)	1 (2)

Relation between symptom score and age of thrombus—Table III gives the mean symptom score at the mean follow-up time six years according to the age of the thrombus visible on the phlebograph. When the symptom scores in the three age groups were analysed using the *t* test the mean score of the legs containing thrombi that were over 14 days old was significantly greater than that of both the other groups. Table IV subdivides the symptom score into three grades but divides the thrombus into only fresh thrombus, 0-6 days old, and aging thrombus, $\geqslant$ 7 days old, an easier phlebographic classification. The older thrombus appeared to be associated with a higher incidence of moderate and severe postphlebitic symptoms ($\chi^2 = 14{\cdot}2; p \leqslant 0{\cdot}01$).

TABLE III—*Relation between phlebographic age of thrombus and mean postphlebitic symptom score*

Age of thrombus (days):	0-6	7-14	>14
Mean (±SD) symptom score:	2±3·2	3·5±3·9	6·3±4·7

0-6 *v* 7-14: p = 0·5; 0-6 *v* >14: p = 0·003; 7-14 *v* : >p = 0·02.

TABLE IV—*Relation between phlebographic age of thrombus and severity of postphlebitic symptoms. Results are numbers (percentages) of legs*

Age of thrombus	Incidence of symptoms		
	None or mild (0-3)	Moderate (4-9)	Severe (10-15)
Fresh (0-6 days) (35 legs) ..	32 (91)	1 (3)	2 (6)
Aging (>7 days) (48 legs)	26 (54)	16 (33)	6 (13)

$\chi^2 = 14{\cdot}2; p < 0{\cdot}01$.

Relation between symptom score and upper limit of thrombosis—When we devised the scoring system for the phlebographic appearance of the thrombus we assumed that the more extensive the thrombus, especially the higher it was in the leg, the greater the likelihood of postphlebitic sequelae and so we added the scores for each segment together.

TABLE V—*Relation between upper limit of thrombosis and postphlebitic symptoms and signs. Results are numbers (percentages) of legs*

Upper limit of thrombosis	Incidence of symptoms		
	None or mild (0-3)	Moderate (4-9)	Severe (10-15)
Calf	29 (80)	6 (17)	1 (3)
Thigh	18 (70)	5 (17)	4 (13)
Pelvis	11 (55)	6 (30)	3 (15)

Occlusive iliac vein thrombosis was also given a slightly greater score (4 instead of 3) than occlusive femoral vein thrombosis. Table V relates the symptom scores to the upper limit of the thrombosis. The extent of the thrombosis appeared to make no difference to the incidence of the three grades of symptom. For all 130 legs $\chi^2 = 12{\cdot}2$; $p > 0{\cdot}05$; for the 83 legs with thrombosis $\chi^2 = 5{\cdot}4$; $p > 0{\cdot}2$.

Relation between symptom score and patient's age at time of thrombosis—The ages were analysed in decades. There were no differences in the symptom scores between the age groups. For example, the average symptom score after a thrombosis in patients aged under 40 years was 3 and in those over 40 years 2·7. The average symptom score in the control legs was 1·4 in the patients aged under 40 years and 1·2 in those aged over 40 years.

Effect of prethrombosis symptoms on symptoms 5-10 years later—Sixteen of the 83 legs that contained thrombus had had symptoms before the thrombosis, scoring 1·4. Their average phlebographic score was 3·6. At follow-up their average symptom score was 2. The symptom score at follow-up of the 67 legs that were symptomless before the thrombosis (which scored 4·4) was 3. None of these differences were statistically significant.

Discussion

The belief that the postphlebitic leg syndrome is always caused by a deep-vein thrombosis stems mainly from the work of Bauer,[4] who followed many patients with extensive thrombosis for many years. The two major deficiencies of his study were that he made no control comparisons and studied only the grossest form of thrombosis.

Although many legs with a severe postphlebitic syndrome have a history of thrombosis it does not follow that all thromboses cause severe sequelae, or that all "postphlebitic" syndromes are actually caused by a thrombosis. Doubts about this relationship were raised by the findings of Browse and Clemenson,[5] who recorded that 8-11% of legs which were normal on the fibrinogen uptake test after operation had symptoms three years later, and by Mudge and Hughes,[6] who observed that five out of eight patients who developed a new postphlebitic syndrome after operation had had no evidence of postoperative thrombosis.

Unfortunately the present study does not contain a pure control group, for although we studied a group of legs that were phlebographically normal they were the legs of patients with a thrombosis in the contralateral leg, patients whose coagulation mechanism must have been abnormal, and they had been subjected to phlebography, which itself may have caused some thrombosis. This latter point is important when considering the possible reasons for the development of symptoms, sometimes quite severe, in the normal leg.

The important conclusion from this study is that the development of the postphlebitic syndrome is totally unpredictable. From a statistical point of view one can tell a patient with a moderate to severe thrombosis—that is, a thrombosis that extends above the knee joint into the femoral vein or an occlusive iliac vein thrombosis—that he or she has a 25% chance of having no symptoms, a 35% chance of having mild symptoms, and a 40% chance of having moderate or severe symptoms five to 10 years later (table I). Looked at in this way the chance of getting some symptoms in the leg are considerable (74%), but for most patients these symptoms are minor aches and pains and a few varicose veins. The most surprising finding was that 20% of patients with a calf thrombosis or a small non-adherent local

femoral or iliac thrombosis and 13% with no thrombosis at all could expect moderate to serious symptoms. This finding is similar to that of a previous study[7] in which we found postphlebitic symptoms in 20% of legs that had no thrombosis at the time they were first studied (three years earlier).

The lack of a simple correlation between the extent of the thrombosis and the symptoms can be explained in two ways. Either our analysis of the phlebogram does not highlight the critical aspect of the thrombosis that produces the late sequelae—for example, thrombosis in communicating veins—or another factor is implicated. Both are likely explanations. Phlebography cannot display every vein and the intricacies of the calf muscle venous pump are still a mystery. Possibly one small segment of thrombotic occlusion or valve destruction at a critical point within the pump may cause far more disorganisation of pump function than an extensive thrombosis elsewhere. But even if our crude assessment of the extent of the thrombosis gave no indication of the damage to the calf pump it is also likely that the postphlebitic syndrome is not just a result of calf pump damage but a combination of this damage and the tissue response to the resulting venous hypertension. We have shown that venous hypertension causes changes in capillary permeability and leads to the deposition of extravascular fibrin.[8 9] This fibrin must be cleared away and we have suggested that a deficiency of vein wall and interstitial fibrinolysis may be an important factor in producing the postphlebitic phenomenon.[10] Blood fibrinolytic activity was measured at the follow-up examination of the patients in this study and there was just a statistically significant correlation ($p=0.05$) between the symptom score and the blood fibrinolytic activity, but no definite conclusions should be made from this association without a prospective study.

These studies show that the postphlebitic leg syndrome is not as simple as its name suggests. It may not always be postphlebitic, and until we have a better understanding of the calf pump and the course of events between a thrombosis and the appearance of symptoms we should use the name with caution. The term "postphlebitic syndrome" is a useful clinical description but we must remember that an exclusive causal relationship between the thrombosis and the syndrome and the mechanisms of symptom production have not yet been established.

References

1 O'Donnell TF, Browse NL, Burnand KG, and Lea Thomas M. The socioeconomic effect of an ilio-femoral thrombosis. *J Surg Res* 1977;**22**: 483-8.

2 Lea Thomas M. Phlebography. *Arch Surg* 1972;**104**:145-50.

3 Lea Thomas M, McAllister V. The radiological progression of deep vein thrombosis. *Radiology* 1971;**99**:37-40.

4 Bauer G. A roentgenological and clinical study of the sequelae of thrombosis. *Acta Chir Scand* 1942; Suppl 74.

5 Browse NL, and Clemenson G. Sequelae of an ^{125}-fibrinogen detected thrombus. *Brit Med J* 1974;ii:468-70.

6 Mudge M, Hughes LE. The long term sequelae of deep vein thrombosis. *Br J Surg* 1978;**65**:692-4.

7 Young AE, Lea Thomas M, Browse NL. Comparison between the sequelae of surgical and medical treatment of venous thromboembolism. *Br Med J* 1974;iv:127-33.

8 Burnand KG, Clemenson G, Whimster IM, Browse NL. Extravascular fibrin deposition in response to venous hypertension. *Brit J Surg* 1976; **63**:660.

9 Browse NL, Burnand KG. The postphlebitic syndrome, a new look. In: Bergen JJ, Yao ST, eds. Venous problems. Yew Book: Chicago, 1978.

10 Wolfe JH, Morland M, Browse NL. The fibrinolytic activity of varicose veins. *Br J Surg* 1979;**66**:185-7.

(*Accepted 19 September 1980*)

How long should patients with suspected myocardial infarction be under observation in hospital?

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Summary and conclusions

Out of 368 patients admitted to hospital for chest pain and suspected acute myocardial infarction, 267 were discharged within 24 hours on the basis of the clinical picture, electrocardiogram, and serum activities of aspartate transaminase, alpha-hydroxybutyrate dehydrogenase, and creatine phosphokinase. The patients were followed up for 28 days, during which 17 were readmitted, two of them twice and one three times. Two of the patients were readmitted with non-fatal acute myocardial infarction, and two died. The patients had been primarily divided into two groups: those admitted with presumably non-coronary chest pain (77 patients) formed group 1 and those with obvious coronary chest pain (190 patients) group 2. Both deaths occurred in patients in group 2 but the incidences of events during the follow-up period were otherwise similar in the two groups, and some patients in both groups may have had small acute myocardial infarctions when first admitted.

The decision to keep in hospital or discharge a patient with chest pain of recent onset can be made within 24 hours of admission. To discharge the patient acute myocardial infarction need not necessarily be excluded and conventional tests are enough to enable a decision to be made.

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Introduction

Patients presenting at the emergency department of this hospital for obvious acute myocardial infarction are admitted direct to the coronary care unit. Patients presenting with chest pain in whom the diagnosis is not immediately clear, however, are first admitted to the observation ward, for 24 hours at the most. If acute myocardial infarction is confirmed, or if chest pain continues or recurs, the patient is moved to the coronary care unit or sometimes to an ordinary ward; otherwise he is discharged. Thus the observation ward acts as a regulator between the emergency department and other wards, allowing the limited number of beds to be used efficiently.

The decision to discharge a patient from hospital or move him to the coronary care unit or another ward is based on the clinical picture, electrocardiogram, and serum activities of aspartate transaminase, α-hydroxybutyrate dehydrogenase, and creatine phosphokinase. Recently the MB fraction of creatine phosphokinase has also been determined. We carried out a study