A SEGMENTAL APPROACH TO THE PROBLEMS OF VENOUS THROMBOEMBOLISM

VOLUME II

TABLE I

DETAILS OF DISSECTIONS

Code and Category		5 R	5 L	9 R	9 L	13 R	13 L	17 R	17 L	22 R	26 R	26 L	30 R	30 L	32 R	34 L	39 L	43 L	47 R	47 L	51 R	51 L	Inj. Spec.
1. Profunda-Popliteal Connections	a) Direct Popliteal V. to Profunda V.	-	+	-	-	+	-	-	-	-	-	+	-		-	+	+	+	-	+	-	-	+
	b) Connection between Profunda and tributary of Popliteal	+	-	+	+	-	+	+	+	-	+	-	-		+	-	-	-	+	-	+	-	-
	c) Between Profunda V. and Venae Com. of Popliteal A.	-	-	-	+	-	-	-	-	+	-	+	+		-	-	-	-	-	-	-	-	-
2. Venae Comitantes of Popliteal Artery Communicate with those of Femoral Artery		+	+	+	+	+	+	+	+	-	+	+	+	+	+	+	+	+	-	+	-	+	+
3. Level of Termination of Venae Comit. of Femoral A.	a) Less than half-way to Profunda V.	-	-	-	-		-		-	-		+	-	-	-	-	-	-		-	-	-	+
	b) More than half-way to Profunda V.	-	-	-	+		-		+	-		-	-	+	-	+	+	+		+	+	+	-
	c) At or in the Profunda V.	+	-	+	-		-		-	+		-	+	-	+	-	-	-		-	-	-	-
	d) Proximal to Termination of Profunda V.	-	+	-	-		+		-	-		-	-	-	-	-	-	-		-	-	-	-

TABLE II

Results of Dissections

Code and Category		Number	Percentage	Corrected Percentage
1. Profunda–Popliteal Connections.	a) Direct Popliteal to Profunda	8	36	38
	b) Connection between Profunda and tributary of Popliteal	10	45	48
	c) Between Profunda V. and Venae Com. of Popliteal A.	4	18	19
2. Venae Comitantes of Popliteal Artery Communicate with those of Femoral Artery.		19	86	86
3. Level of Termination of Venae Comit. of Femoral A.	a) Less than half-way to Profunda V.	2	9	11
	b) More than half-way to Profunda V.	9	41	50
	c) At or in Profunda V.	5	33	28
	d) Proxima to termination of Profunda V.	2	9	11

TABLE III

Distribution of Thromboses in 283 Legs operated on for Deep Vein Thrombosis

High Onset		Low Onset	
Localised	With distal propagation	Localised	With proximal propagation
(2)42 (15%)	186 (65%)	(1)31 (11%)	24 (9%)

(1) The figure in the localised peripheral deep vein thromboses referred to patients as these had bilateral superficial femoral vein ligation, and the leg involved was frequently not determined.

(2) Includes 14 non-occlusive iliofemoral venous thromboses.

TABLE IV

Distribution of Thromboses in 55 cases presenting with Pulmonary Embolism, initially without clinical leg signs

Onset in iliofemoral segment		36
	"Silent" legs	14
	"Late" legs	22
Onset in peripheral segment		19
	"Silent" legs	11
	"Late" legs	8 *

"Silent" indicates no clinical signs, and in the iliofemoral segment non-occlusive thrombosis.

"Late" indicates that clinical signs subsequently developed.

* 2 of these cases showed propagation into the iliofemoral segment.

TABLE V

Comparison of Mortality in Peripheral and Iliofemoral Venous Thrombosis

	Pre-operative Embolism	Postoperative Embolism	
		Non-fatal	Fatal
Iliofemoral Thrombosis (Thrombectomy)	113	25	7
Lower Segment Thrombosis (Superficial femoral vein ligation)	31	3	0

TABLE VI

Leg involvement in 228 cases of Iliofemoral Venous Thrombosis

	Right leg	Left leg
D.V.T. without embolism	26 (20%)	100 (80%)
D.V.T. with embolism	46 (37%)	80 (63%)
Total*	72 (28%)	180 (72%)

* 24 cases had bilateral iliofemoral thromboses.

TABLE VII

"Late" clinical iliofemoral involvement in 113 cases with pulmonary embolism

High onset	22	
Low onset	2	
Total	24	(21% of all cases with embolism)

TABLE VIII

Distribution of Thromboses in 238 legs with complete iliofemoral occlusion

High Onset		Low Onset
Localised	with distal propagation	with propagation
28 (12%)	186 (78%)	24 (10%)

TABLE IX

Anticoagulant Failure

	Total	Referred after failure of anticoagulant therapy
With embolism	113 *	81 (71%)
Without embolism	118 *	40 (34%)

* 3 patients are included in both groups as they had 1 episode with embolism and one without, the attacks being separated in time.

TABLE X

Distribution of Thromboses in 144 patients with Pulmonary Embolism

		Clinical Diagnosis	Thrombectomy and/or Venographic Evidence
Iliofemoral Onset	Remaining proximal	17	13
	With distal propagation	66	80(1)
	"Silent" legs		14(2)
	Total	83	107
Peripheral Onset	Remaining Peripheral	20	20(3)
	With proximal extension	16	6(4)
	"Silent" legs		11(5)
	Total	36	37

(1) Includes 11 cases with dual origin.

(2) "Silent" leg denotes incomplete iliac occlusion here.

(3) Includes 6 "late" leg cases without extension.

(4) Includes 2 "late" leg cases with extension.

(5) Asymptomatic peripheral thromboses, of which 6 gave rise to symptoms following superficial femoral vein ligation.

TABLE XI

Signs of Deep Vein Thrombosis Present but Unrecognised

	Segment involved	
	Iliofemoral	Peripheral
Remaining localised	6	4
With propagation	22	1
Total	28	5

TABLE XII

Diagnostic Difficulties

289* Cases of Occlusive Iliofemoral Thrombosis

Not diagnosed when signs present	47 (17%)
Not diagnosed when signs present including embolism	28 (10%)

*75 were treated conservatively

TABLE XIII

Clinical Leg Involvement in Iliofemoral Thrombosis

(228 patients)

Bilateral involvement	24 (11%)
Venous gangrene	4 (2%)
Blue leg	141 (62%)
Associated embolism	113 (49%)
"Silent" leg	14 (6%)

TABLE XIV

"Malignant" Thrombo-embolism - 18 cases

Bilateral iliofemoral involvement	11
Repeated episodes before thrombectomy	10
Recurrent attacks after thrombectomy	9
Eventual inferior vena cava ligation	5
Mortality	4*

* 3 During present illness

1 from mesenteric venous occlusion in a subsequent pregnancy.

TABLE XV

Venous Gangrene

Authors	Number of Cases		On anticoagulants when gangrene developed		Number with iliofemoral or caval thrombosis	
	In Series	With gangrene	Number	Percentage	Number	Cases Examined*
Haimovici (1951)	2	2	2	100%	2	-
Catchpole (1957)	5	3	3	100%	2	2
Humphrey and Davie (1954)	1	1	1	100%	1	-
Ross et al. (1961)	11	11	6	54%	8	8
Cywes and Louw (1962)	2	1	1	100%	2	-
Lowenthal and May (1965)	5	5	3	60%	2	2
Sutton (1966)	6	6	4	66%	2	2
Present Series	6	5	3	50%	6	6
Total	38	34	23	60%	25	20

* Post-mortem, Operation, Venography

TABLE XVI

Venous Gangrene - 6 Cases

Case No.	Sex	Age	Aetiology	Previous Anticoag.	Embolism	Shock	Iliofemoral Thrombosis*	Thrombectomy	Died	Comment
1	Female	67	Post-operative	Yes	Yes	Yes	Yes	No	Yes	---
2	Female	72	Spontaneous	Yes	Yes	Yes	Yes	Yes	Yes	Incomplete thrombectomy and early rethrombosis
3	Male	42	Spontaneous	No	Yes	No	Yes	No	No	Relatively mild disease
4	Female	54	Medical	No	Yes	No	Yes	Yes	Yes	Death resulted from carotid artery occlusion
5	Male	43	Spontaneous	Yes	Yes	No	Yes	Yes	No	---
6	Male	48	Post-operative	No	No	Yes	Yes	Yes	No	Died 3/12 later from carcinoma

* Determined by venography, operation or autopsy

TABLE XVII

Age Distribution

	Years
Youngest	19
Oldest	89
Average age	45
Average age with embolism	49
Average age without embolism	42

TABLE XVIII

Sex Incidence in Venous Thrombosis

	Female	Male
With embolism	66 (58%)	47 (42%)
Without embolism	82 (69%)	36 (31%)
Total	148 (64%)	83 (36%)

TABLE XIX

Aetiological Factors

231 Episodes of DVT

Idiopathic	40 (17%)
Medical	42 (18%)
Postoperative	95 (41%)
Ante- and post-partum	54 (23%)

TABLE XX

Clinical Follow-up of Iliofemoral Venous Thrombectomy

Group A	No venographic control
104 cases - over 2-14 years (average 8 years)	
Normal legs	46 (44%)
Minimal complaints	48 (46%)
Venous insufficiency	10 (10%)

TABLE XXI

Correlation of Venographic and Clinical Follow-up

Group A

31 Cases - 2-14 years (average 6 years)

Clinical Follow-up	Venographic Follow-up		
	Normal upper segment	Direct Channels	Cross Channels
Normal legs	10	2	1
Minimal complaints	2	5	8
Venous insufficiency	0	1	2

TABLE XXII

Operative Clearance and Rethrombosis within 14 days

67 Cases

		Post-operative Venography		
	Operative Clearance	No change	Partial Rethrombosis	Complete Rethrombosis
Complete clearance	42 (63%)	37 (55%)	4 (7%)	1 (1.5%)
Partial clearance	25 (37%)	16 (25%)	6 (9%)	3 (4.5%)

TABLE XXIII

Correlation of Venographic and Clinical Follow-up

Group B 3 months - 5 years (average 3 years)

	Venographic Follow-up		
Clinical Follow-up	Normal Upper segment	Direct Channels	Cross Channels
Normal legs	10	3	0
Minimal complaints	3	4	1
Venous insufficiency	0	0	4

TABLE XXIV

Clinical Follow-up of Iliofemoral Venous Thrombectomy

Group B

54* cases - over 3 months - 7 years (average 3 years)

Normal legs	29 (54%)
Minimal complaints	20 (37%)
Venous insufficiency	5 (9%)

* 25 had venographic follow-up (Table XXIII)

TABLE XXV

Post-thrombectomy Rethrombosis

	Total	Rethrombosis within 14 days	Total Reviewed	Late Rethrombosis	No Change
Complete clearance	42	5	16	3*	13
Partial clearance	25	9	9	2*	7

* 2 Cases had a further episode of iliofemoral venous thrombosis treated conservatively 6 months and 2 years later.

TABLE XXVI

Rethrombosis in Incomplete Clearance

Residual Thrombus	Operative	No change	Partial Rethrombosis of upper segment	Complete Rethrombosis of upper segment
Common iliac vein	20	14	5	2
Common iliac and external iliac vein	5	3	1	1

TABLE XXVII

Effect of pre-operative delay on venous clearance and post-operative rethrombosis.

56* Cases with early post-operative venography

	Delay 14 days		Delay 14 days	
	Total	Rethrombosis	Total	Rethrombosis
Complete clearance	27	4	4	1
Partial clearance	21	6	4	3

* Excludes silent leg cases and caval thrombectomites.

TABLE XXVIII

Clinical Response 252 Venous Thrombectomies

	Total	Leg symptoms (1) unaltered	Failed to (2) subside
Complete clearance	78	0	0
Incomplete clearance	126	1	21
Failure	48	5	12

(1) Cases where leg signs did not subside within 36 hours.

(2) Cases where temperature, E.S.R. or leg signs failed to subside.

TABLE XXIX

Pulmonary Embolism Following Iliofemoral Venous Thrombectomy

228 Cases

	Total	Postoperative Non-fatal embolism	Fatal Embolism
Pre-operative embolism	113 *	21 (19%)	7 (6%)
No embolism before operation	118 *	4 (3%)	0

* 3 patients are included in both groups as they had one episode with and one without embolism, the attacks being separated in time.

TABLE XXX

Embolism after Thrombectomy related to pre-operative delay

228 Cases

Delay in days	0 - 2	2 - 7	7 - 14	14 +
Non-fatal embolism	2	4	5	14
Fatal embolism	0	1	0	6

TABLE XXXI

Control of Embolism by Iliofemoral Venous Thrombectomy

*113 Cases

	Complete Clearance	Partial Clearance	Failure
Total	35	53	23
Further embolism	3 (8%)	10 (19%)	8 (35%)
Fatal embolism	0	4 (8%)	3 (13%)

* 2 died at operation.

TABLE XXXIII

Operative Clearance in Occlusive Iliofemoral Thrombosis

Venographic Assessment

	Right Leg	Left Leg
Complete Clearance	9	22
Partial Clearance	10	37

This includes six cases with bilateral thrombosis, but excludes 8 cases with embolism and non-occlusive thrombosis and 6 occlusive cases treated by caval thrombectomy.

TABLE XXXIV

Caval Thrombectomy

Total	7
Deaths	2*
Follow-up	5
Patent iliofemoral segment	5

* Deaths not related to thrombo-embolism.

TABLE XXXV

Iliofemoral venous thrombosis in pregnancy

51 Cases

	Without Embolism	With Embolism	Total
Ante-Partum	14	5	19
Post-Partum	25	10	35

TABLE XXXVI

Topical Urokinase in Post-Thrombectomy Residual Thrombosis

Case No.	Iliofemoral Clearance at Thrombectomy	Venographic Evidence of Rethrombosis	UROKINASE				Venographic Evidence of Lysis
			Critical Activator Concentration	Dosage u/min.	Duration in hours	Total Dose	
1	Incomplete	Slight	120 u	120 240	18½ 6½	225,000 u	Slight
2	Incomplete	Nil	35 u	75	11	50,000 u	None
3	Incomplete	Minimal	60 u	120	23½	175,000 u	None
4	Incomplete	Nil	105 u	210	14	175,000 u	None

None of these patients demonstrated systemic fibrinolysis.

Cost range per patient £76 - £342.

TABLE XXXVII

Topical Urokinase for Rethrombosis after Thrombectomy

Case No.	Iliofemoral Clearance at Thrombectomy	Venographic Evidence of Rethrombosis	UROKINASE				Venographic Evidence of Lysis
			Critical Activator Concentration	Dosage u/min.	Duration in hours	Total Dose	
5	Incomplete	Moderate	100 u	160	7½	50,000 u	Complete
6	Incomplete	Extensive	120 u	200 250	6 12	250,000 u	None
7	Incomplete	Moderate	60 u	120	11½	75,000 u	Moderate
8	Incomplete	Extensive	120 u	240 480	8 6	300,000 u	Slight
9	Complete	Extensive	100 u	150 200	6 6	125,000 u	Moderate
10	Incomplete	Extensive	90 u	180 360	8 6	205,000 u	Slight

None of these patients demonstrated systemic fibrinolysis.
Cost range per patient £76 - £456.

TABLE XXXVIII

Low Dose Urokinase in Iliofemoral Venous Thrombosis

Fibrinogen and Plasminogen changes

	Fibrinogen	Plasminogen
Pre-infusion	520 ± 60	5.4 ± 0.5
Lowest value recorded	530 ± 120	5.00 ± 1.3

TABLE XXXIX

Streptokinase in Post-thrombectomy Rethrombosis

			RETHROMBOSIS		STREPTOKINASE							
Case No.	Delay before Thrombectomy	Operative clearance	Time after Thrombectomy [1]	Type	Time from Rethrombosis to infusion	Radiographic Assessment of Lysis	Comment	Time from Start of Infusion to Maximum Lysis	Time from Completion of Infusion to Maximum Lysis	Reaction	Haemorrhagic Features	Deaths
1	5 days	Incomplete	2 days	Non-occlusive	3 days	almost complete	-	3 days	2 days	No	No	Gastric Carcinoma
2	3 days	Incomplete	3 days	Occlusive	12 days	marked	no channel produced	5 days	4 days	No	Wound Haematoma	No
3	5 days	Incomplete	6 days	Occlusive	30 days	marked	channel produced	3 days	2 days	No	No	Empyema
4	3 days	Incomplete	3 days	Occlusive	12 hours	moderate	channel* produced	3 days	1 day	Yes	No	Myocardial infarction
5	14 days	Incomplete	14 days	Non-occlusive	24 hours	moderate	-	3 days	1 day	Yes	No	No
6	4 days	Complete	2 days	Non-occlusive	12 hours	complete	-	6 hours	N.A.	Yes	No	No
7	3 days	Incomplete	3 days	Occlusive	36 hours	marked	no channel produced rethrombosis	2 days	0	No	Wound Haematoma	No
8	2 days	Incomplete	2 days	Occlusive	3 days	marked	channel produced rethrombosis	24 hours	12 hours	No	Profuse Wound Bleeding	No
9	1 day	Incomplete	1 day	Non-occlusive	3 days	none	-	-	N.A.	No	Wound Haematoma	No

1 Time from thrombectomy to first signs of rethrombosis.

* Complete clearance established at autopsy.

TABLE XL

Streptokinase Therapy - Complications

Case No.	Allergic Reaction	Haemorrhage	Wound Haematoma	Embolism	Death
1	No	No	No	No	Yes (Carcinoma Stomach)
2	No	No	Yes	No	No
3	No	No	No	No	Yes (Empyema)
4	Yes	No	No	No	Yes (Coronary Occlusion)
5	Yes	No	No	No	No
6	Yes	No	No	No	No
7	No	No	Yes	No	No
8	No	Yes*	Yes	No	No
9	No	No	Yes	No	No

* Haemoglobin fell from 75% to 35% over 36 hours and required 5 pints of whole blood.

TABLE XLI

Streptokinase in Post-Thrombectomy Rethrombosis

Dosage

Case No.	T.I.D.	Duration of Infusion (hours)	Total Dose	Pre-infusion Plasma Fibrinogen Level mg./100 ml.	Minimum Plasma Fibrinogen Level Reached mg./100 ml.
1	100,000 U	29	2,350,000 U	400	80
2	100,000 U	28	3,100,000 U	460	290
3	100,000 U	27	2,850,000 U	540	290
4	100,000 U	52	5,850,000 U	530	80
5	500,000 U	48	4,000,000 U	530	320
6	100,000 U	28	2,850,000 U	410	135
7	500,000 U	48	5,000,000 U	460	300
8	500,000 U	36	3,750,000 U	380	240
9	100,000 U	28	3,100,000 U	320	240

TABLE XLII

Streptokinase in Iliofemoral Venous Thrombosis

Case No.	Delay from occlusion to streptokinase	Embolism	Radiographic assessment of lysis	Comment	Reaction	Haemorrhagic features	Rethrombosis
1	N/A	Yes	Complete	Cardiopulmonary function improved	Yes	Yes	No
2	4 days	Yes	Complete	Cardiopulmonary function unaltered	*Yes	No	No
3	4 days	Yes	Marked	Rethrombosis on streptokinase	No	No	Yes
4	6 days	No	Complete	Rethrombosis post streptokinase	No	No	Yes

* Developed bronchospasm on streptokinase, but had had bronchospasm prior to therapy.

TABLE LXIII

Comparison of Thrombin Clotting with Whole Blood Clotting

Sapheno-femoral infusion	Time (hrs.)	Thrombin clotting time (secs)	Whole blood clotting time (mins)	Lysis/Thrombosis
↑ Streptokinase ↓	0	21	5	↑ Thrombolysis ↓
	24	120	6.5	Rethrombosis
	28	48	7	↑
	42	120	22	
↑ Heparin ↓	68	120	20	Thrombolysis ↓
	75	50	15	

TABLE LXIV

Experimental Veno-Venous Bypass Grafts

20 Dogs

	Reconstructions	Patent
First series	6	3
Second series	6	5
Third series	8	8
Total	20	16 (80%)

TABLE LXV

Experimental Veno-Venous Bypass Grafts

20 Dogs

Series	Dog No.	Early Venography (3-4 weeks post-op)	Graft State at time of sacrifice		
			Duration	Venography	Autopsy
1	1	occluded	6/12	occluded	occluded
	2	occluded	6/12	occluded	occluded
	3	patent	6/12	patent	patent
	4	occluded	6/12	occluded	occluded
	5	patent	6/12	patent	patent
	6	patent	2.5 yrs.	patent	patent
2	7	patent	6/12	patent	patent
	8	occluded	6/12	occluded	patent
	9	patent	8/12	patent	patent
	10	patent	2 yrs.	patent	patent
	11	patent	8/12	patent	patent
	12	patent	6/12	patent	patent
3	13	patent	6/12	patent	patent
	14	patent	6/12	patent	patent
	15	"occluded"	2/12	"occluded"	patent
	16	patent	6/12	patent	patent
	17	patent	6/12	patent	patent
	18	patent	8/12	patent	patent
	19	patent	8/12	patent	patent
	20	patent	8/12	patent	patent

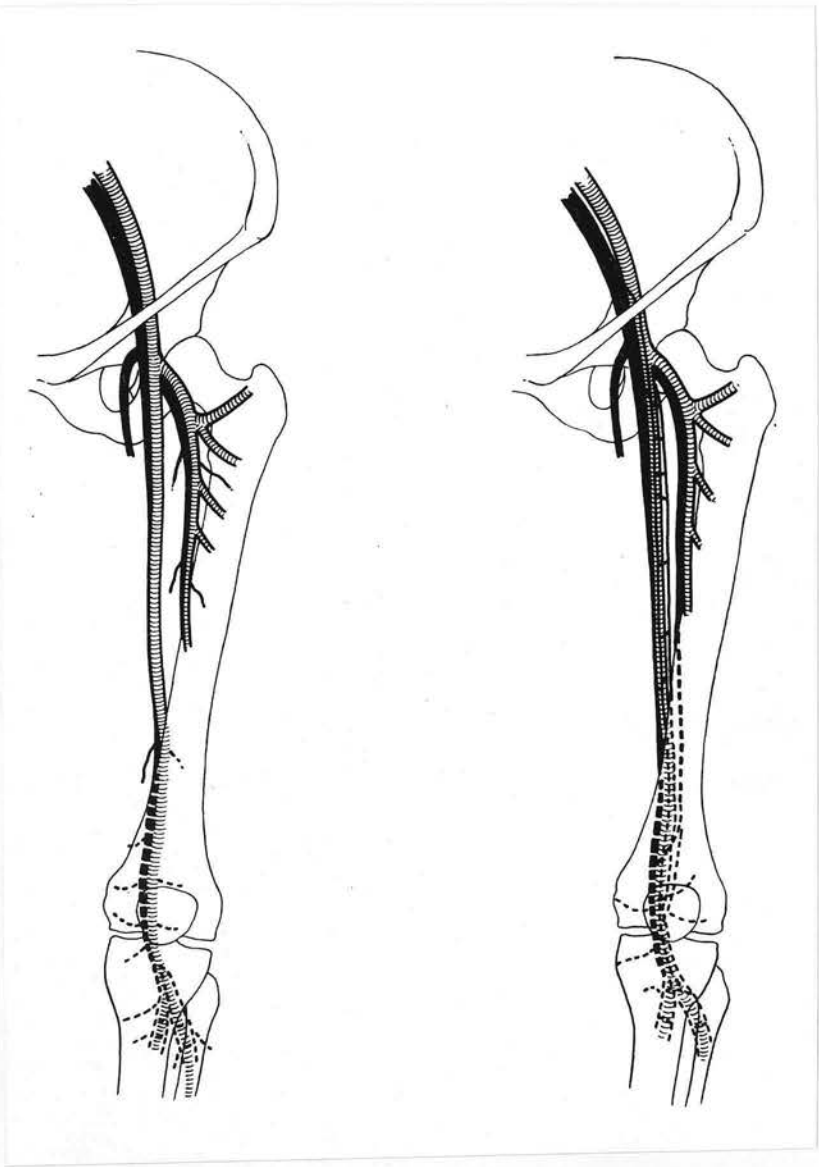
Legend to FIG. 1

Diagrammatic representation of the deep venous system of the lower limb

(a) Classical anatomical arrangement.

(b) Deep venous system based on detailed dissection.

Note the connection of the profunda femoris vein with the popliteal vein and venae comitantes, the continuity of the popliteal and femoral venae comitantes, and the termination of the femoral venae comitantes near the origin of the common femoral vein or even higher.



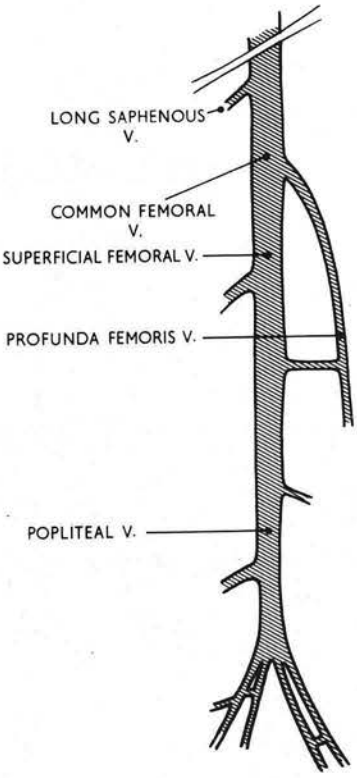
Legend to FIG. 2

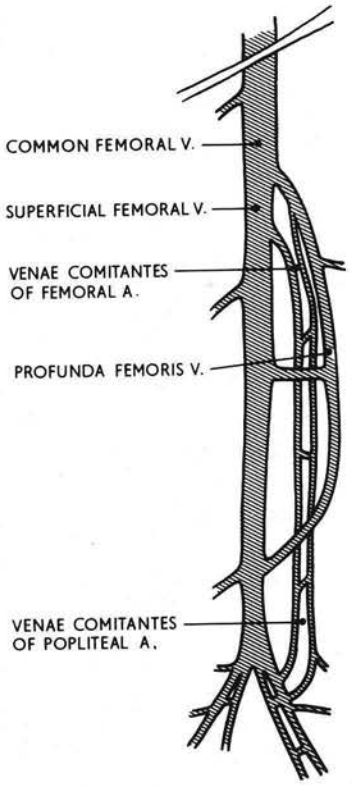
Diagrammatic representation of the deep venous system of the lower limb in linear form to clarify communications

(a) Classical anatomical arrangement.

(b) Details from dissection.

The plexus of veins in the popliteal fossa is formed by the union of the venae comitantes of the lower leg arteries, and the popliteal vein and the venae comitantes of the popliteal artery both arise from this plexus.

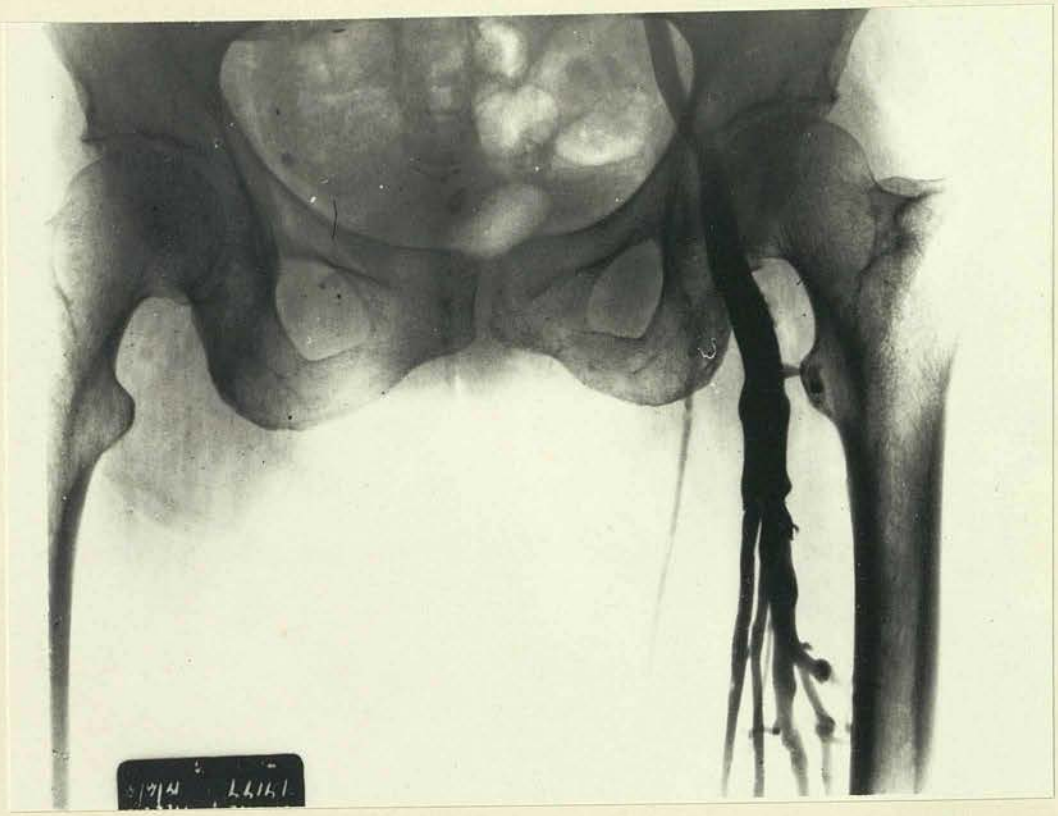




Legend to FIG. 3

Left superficial femoral vein occlusion

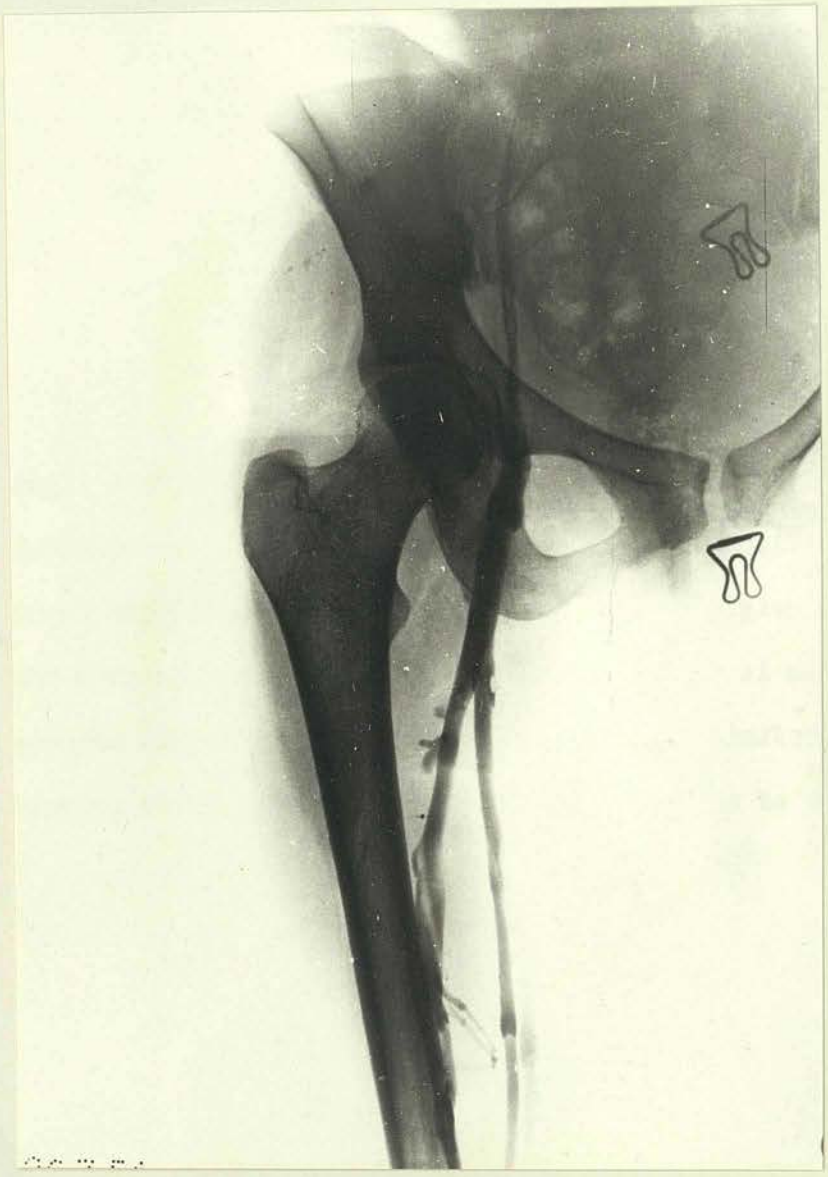
Follow-up venogram 3 months after superficial femoral vein ligation and division for post-partum deep vein thrombosis. The profunda femoris vein is the major route of venous drainage of the lower limb. The femoral venae comitantes have enlarged to a considerable size, and one cross channel is visualised.



Legend to FIG. 4.

Superficial femoral vein occlusion

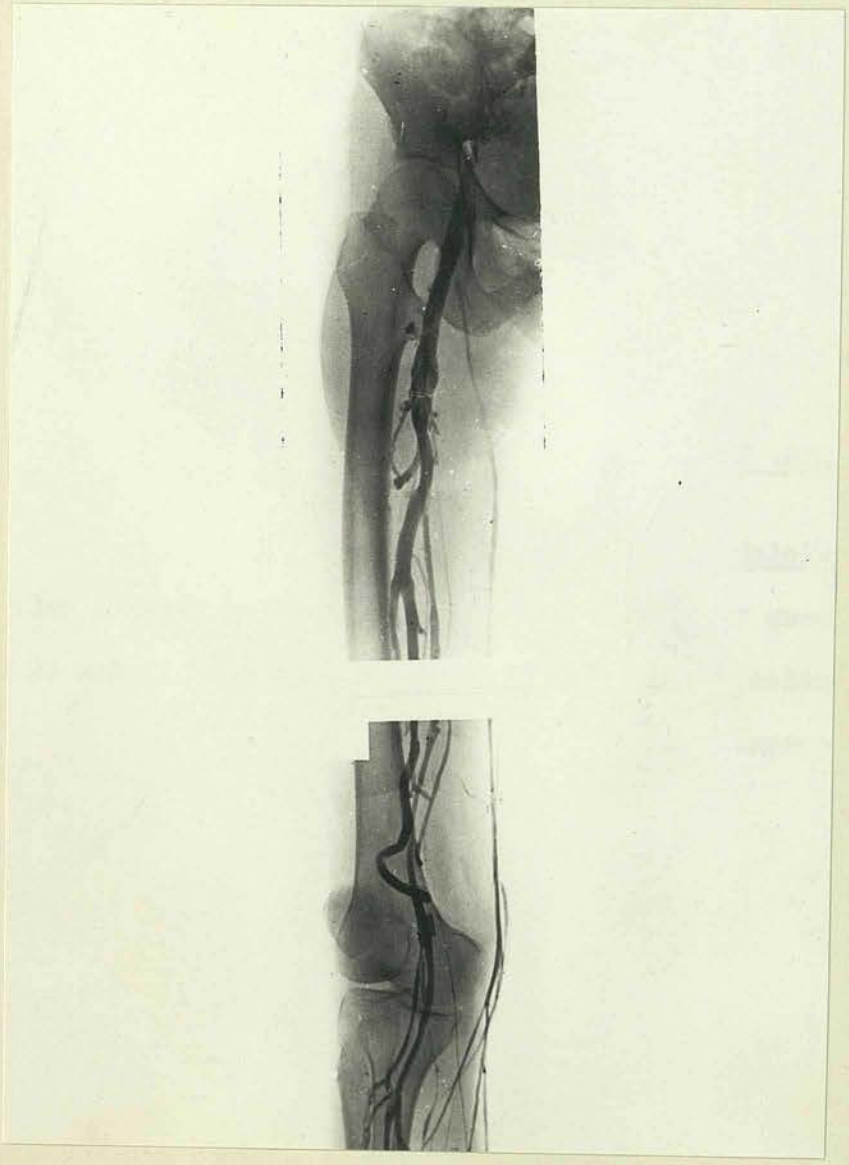
Follow-up venogram 4 years after thrombectomy with ligation and division of the superficial femoral vein. Immediately below the origin of the common femoral vein one of the venae comitantes is so large that it could easily be mistaken for the superficial femoral vein. Despite the marked increase in size of the venae comitantes the valves remain competent.



Legend to FIG. 5

Superficial femoral vein ligation

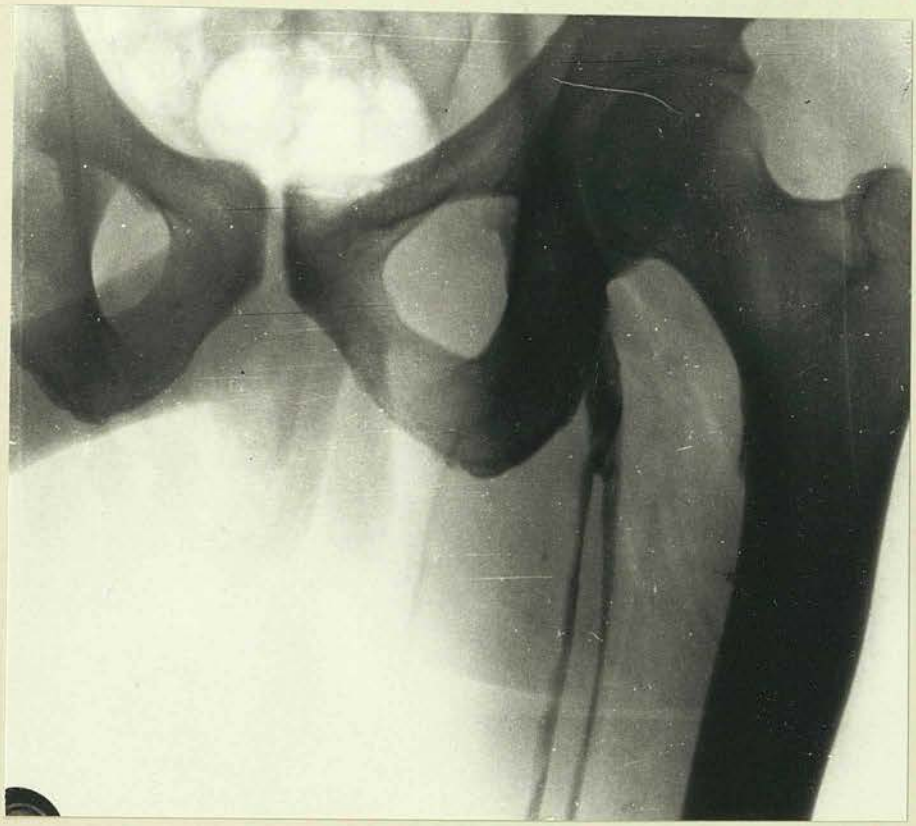
Follow-up venogram 3 years after superficial femoral vein ligation, showing all three major collateral routes of venous drainage.



Legend to FIG. 6

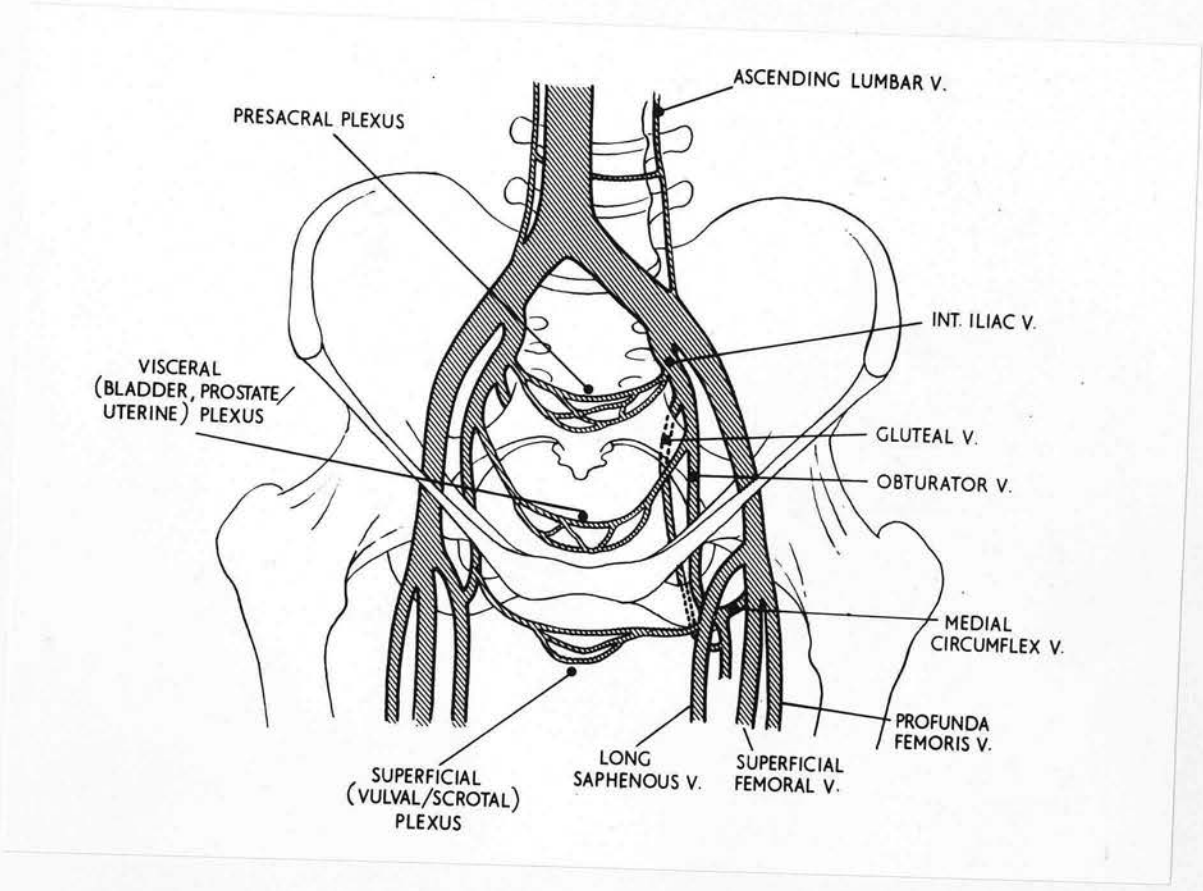
Superficial femoral vein occlusion

Follow-up venogram 2 years after venous thrombectomy of the upper segment with ligation and division of the superficial femoral vein.



Legend to FIG. 7

Diagrammatic representation of the collateral venous system of the iliofemoral segment


ASCENDING LUMBAR V.
PRESACRAL PLEXUS
INT. ILIAC V.
VISCERAL (BLADDER, PROSTATE/ UTERINE) PLEXUS
GLUTEAL V.
OBTURATOR V.
MEDIAL CIRCUMFLEX V.
PROFUNDA FEMORIS V.
SUPERFICIAL (VULVAL/SCROTAL) PLEXUS
LONG SAPHENOUS V.
SUPERFICIAL FEMORAL V.

Legend to FIG. 8

Diagrammatic representation of the major collateral routes of venous return in upper segment occlusion

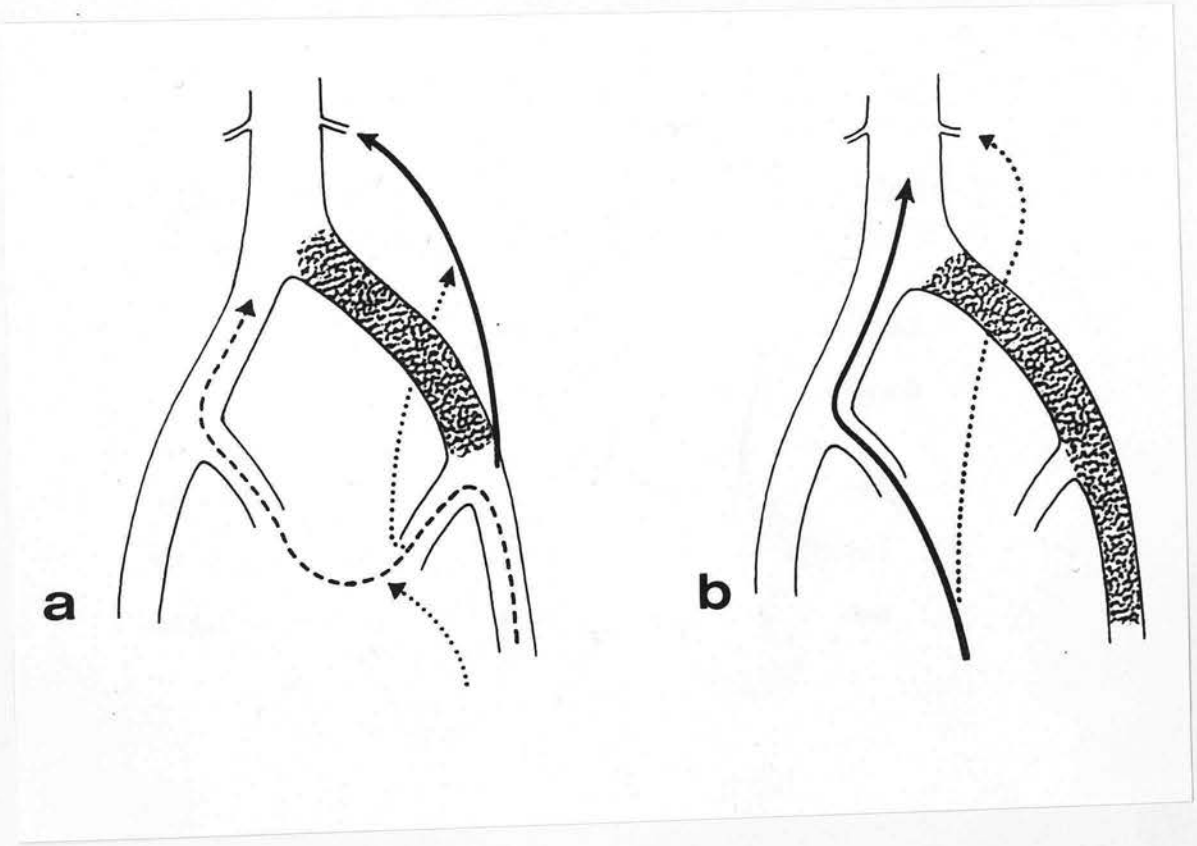
(a) Left common iliac occlusion.

(b) Complete iliofemoral occlusion.

Key: Continuous line - major route of venous return.

Interrupted line - less important collateral channels.

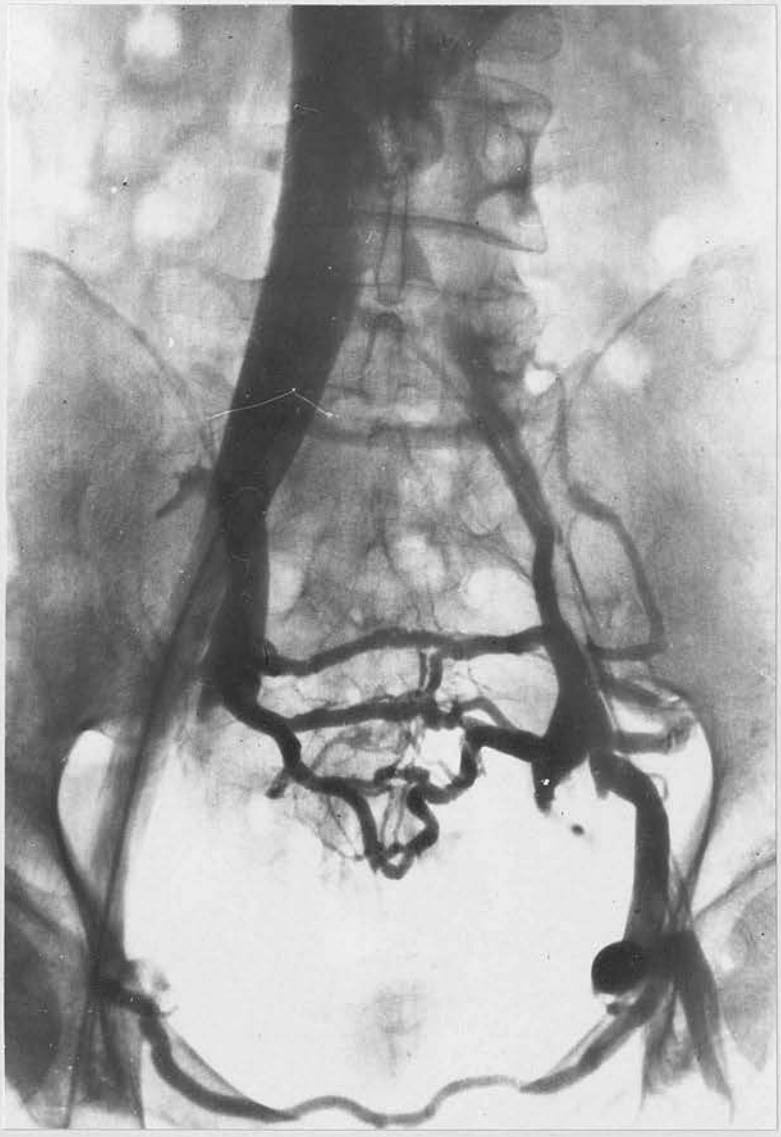
Dotted line - least important routes of collateral venous return.


a
b

Legend to FIG. 9

Left iliac occlusion

This patient, who had an extensive iliofemoral venous thrombosis, was seen too late for venous thrombectomy to be effective and had persisting venous insufficiency. The presacral cross channels are well outlined, and in the lower part of the film the superficial cross-over channels are in evidence.



Legend to FIG. 10

Left common iliac occlusion

Follow-up venogram 11 months after venous thrombectomy for iliofemoral venous thrombosis. Operative venography had demonstrated persisting occlusion of the common iliac vein. Despite this the patient had only moderate venous insufficiency. Collateral venous drainage is provided by the large ascending lumbar vein, and the cross-over channels in the presacral and uterine plexuses.


R

Legend to FIG. 11

Complete iliofemoral occlusion

Venography 4 months after unsuccessful thrombectomy late in the course of an extensive deep venous thrombosis. The superficial femoral vein is also occluded.

Legend to FIG. 12

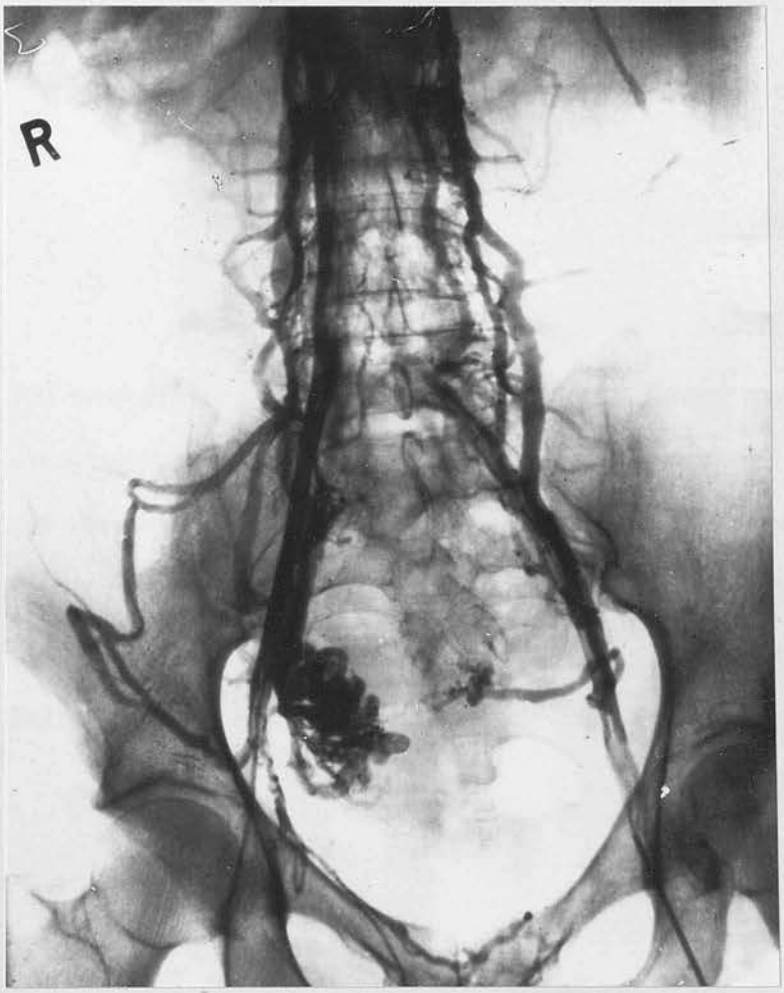
Complete left iliac and femoral vein occlusion

Pre-operative venogram in a patient with an extensive post-partum deep vein thrombosis. After venous thrombectomy, a marked decrease occurred in venous insufficiency.

Legend to FIG. 13

Long-standing bilateral iliofemoral occlusion

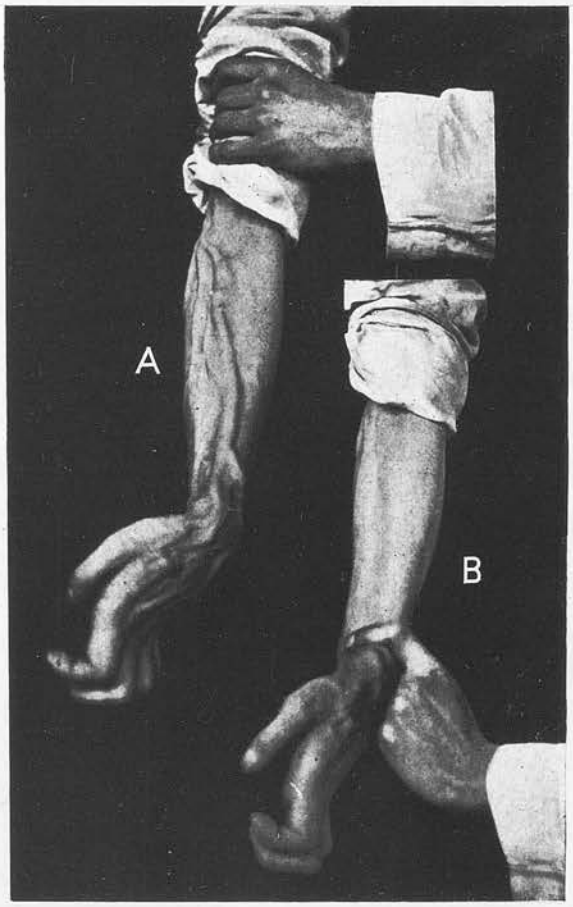
Follow-up venogram 7 years after venous thrombectomy with superficial femoral vein ligation and division on both sides. Patient had a small ulcer at the left ankle but no venous insufficiency. The external and common iliac veins are replaced by the venae comitantes of the corresponding arteries. These channels could easily be described as recanalising main veins.


R

Legend to FIG. 14

Valve competence in a dilated vein (after Kelly 1930)

This patient had a radial artery/cephalic vein A-V fistula. With the artery occluded at the fistula the vein was empty (B) indicating that competent valves prevented it filling from above.



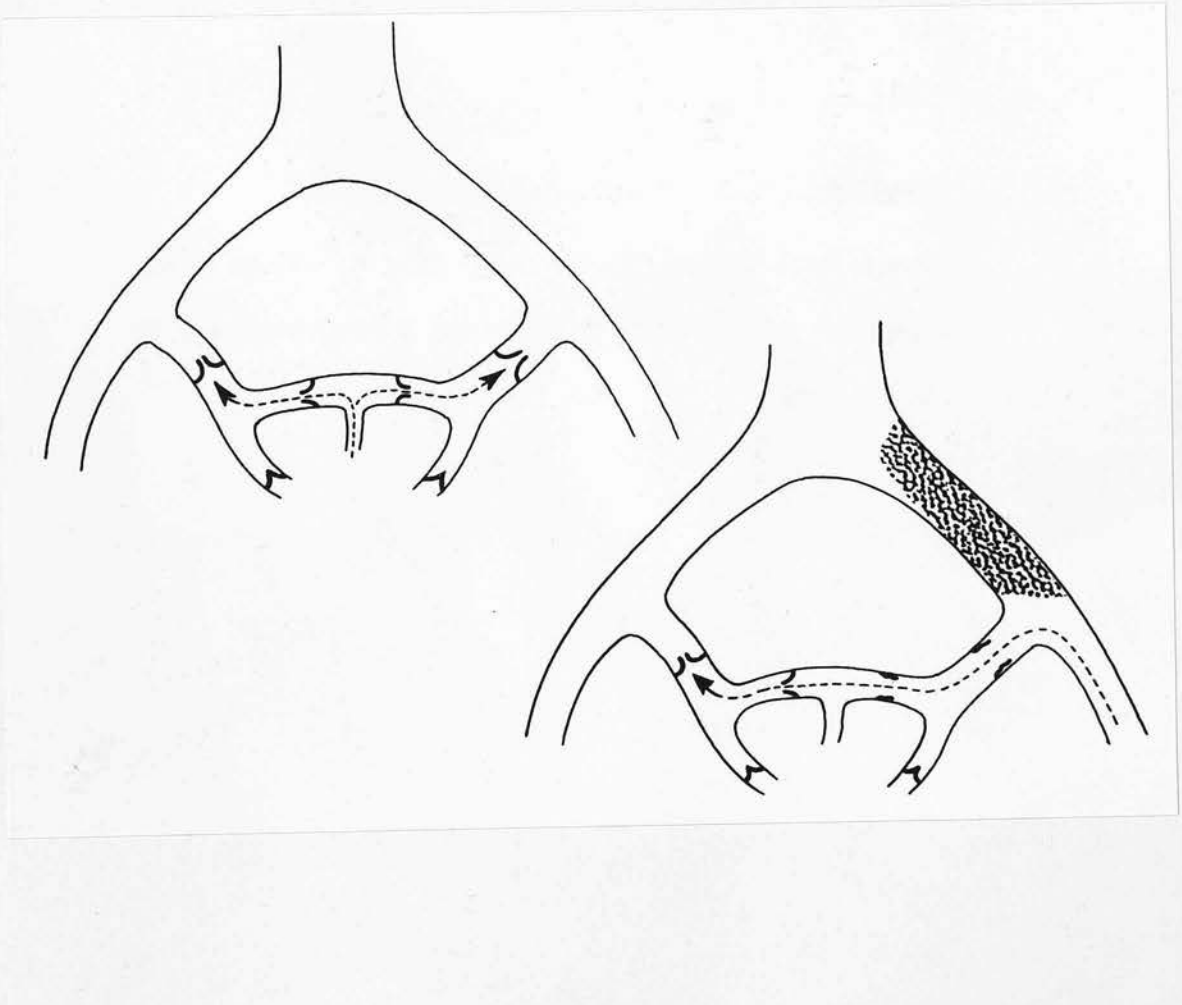
A. Dilatation of radial vein:
B. Vein emptied by stripping, showing competency of valves.

"After Kelly"

Legend to FIG. 15

Diagrammatic representation of a venous circle

This shows that for the cross-connection to act as a collateral channel the valves must be rendered incompetent and the direction of flow reversed.



Legend to FIG. 16

Thrombus removed from common iliac vein at thrombectomy

The thrombus was pale, laminated and extremely tough to handle.

Legend to FIG. 17

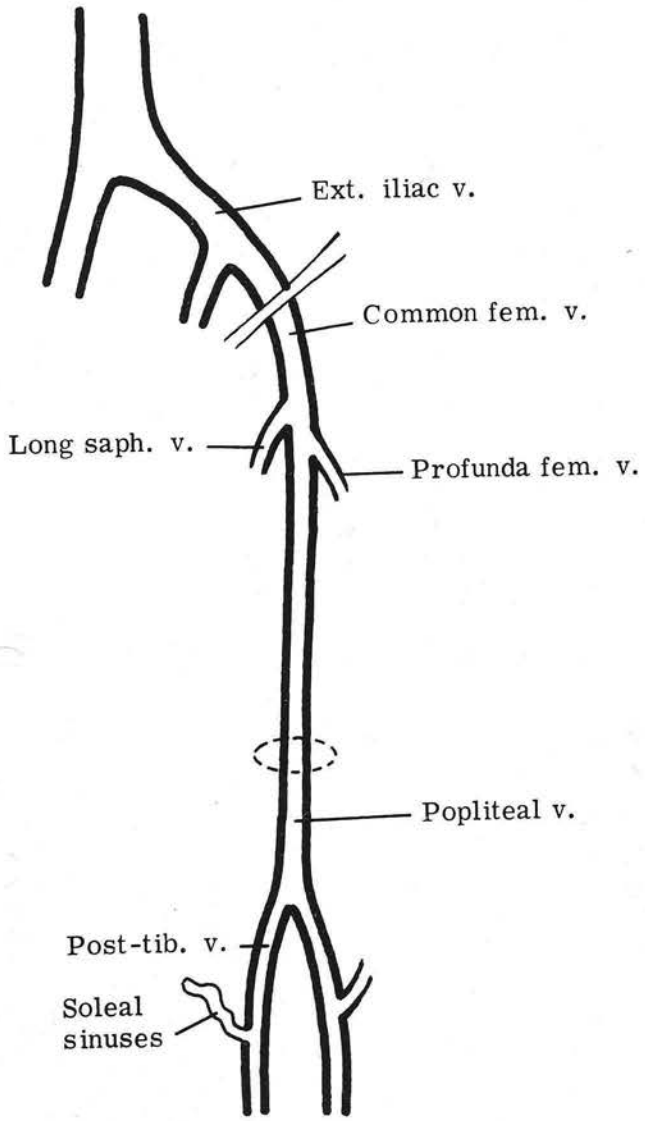
Thrombus removed at thrombectomy

The white thrombus in the upper part was from the external iliac and common femoral veins. The cast of the lower segment shows coagulated whole blood in the superficial femoral vein, with older thrombus in the popliteal vein and one of its lower leg tributaries.

Legend to FIG. 18

Diagrammatic representation of the sites of inception of venous thrombosis

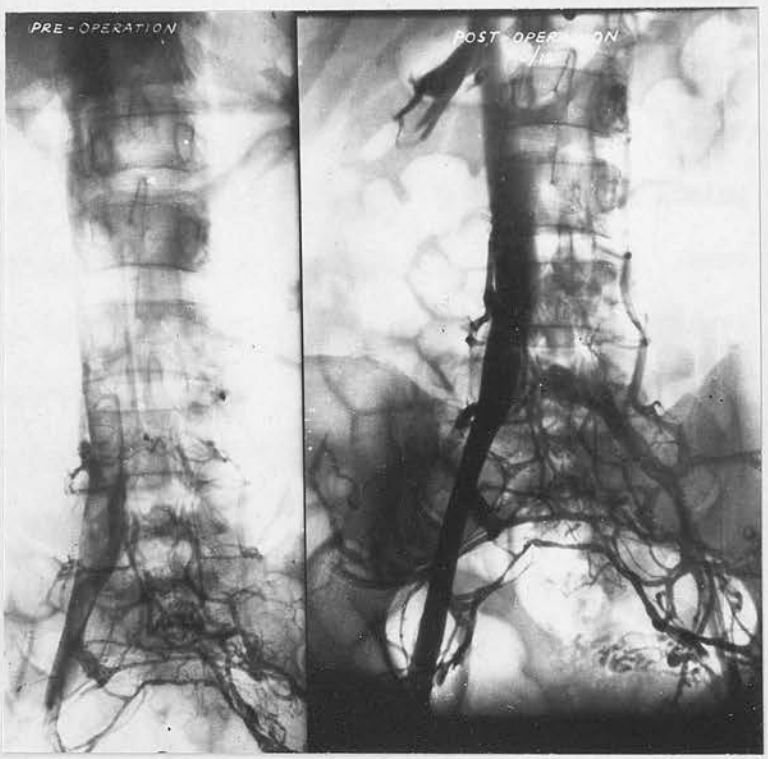
Three are in the upper segment, and three in the lower.


Ext. iliac v.
Common fem. v.
Long saph. v.
Profunda fem. v.
Popliteal v.
Post-tib. v.
Soleal
sinuses

Legend to FIG. 19

Pre-occlusive iliofemoral venous thrombosis

Patient was a 43 year old woman with three episodes of pulmonary embolism. She had suffered a left iliofemoral venous thrombosis 20 years previously with persisting swelling in that leg. Venography (Fig. 19a) by the intraosseous route on the left and direct femoral puncture on the right demonstrated the left iliofemoral thrombosis as well as non-obstructing thrombus in the right common iliac vein and the inferior vena cava. Thrombectomy via the right common femoral vein resulted in complete clearance with arrest of the disease. Post-operative venogram (Fig. 19b) shows complete right iliofemoral and caval clearance.


PRE-OPERATION

Legend to FIG. 20

Post-partum upper venous segment thrombosis

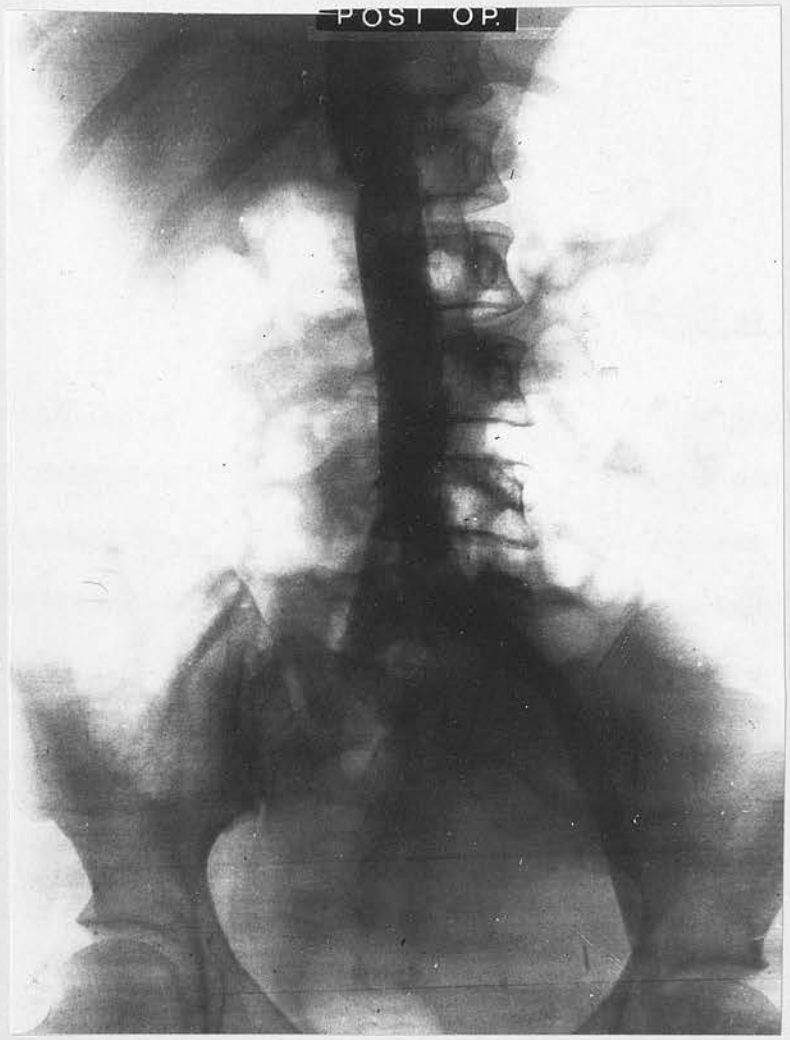
A 24 year old woman developed slight pain in the left calf 3 days after delivery. There was no leg swelling but increased venous markings in the upper thigh. There was tenderness in the inguinal and supra-inguinal regions as well as the calf. At thrombectomy the femoral vein was patent but venography via a tributary of the saphenous vein showed complete occlusion of the common iliac and incomplete thrombosis of the external iliac vein.


BEFORE THROMBECTOMY

Legend to FIG. 21

Post-clearance venogram in case shown in Fig. 20

This appearance was obtained after large amounts of thrombus had been removed from the upper segment, and was maintained throughout the post-operative period.


POST OP.

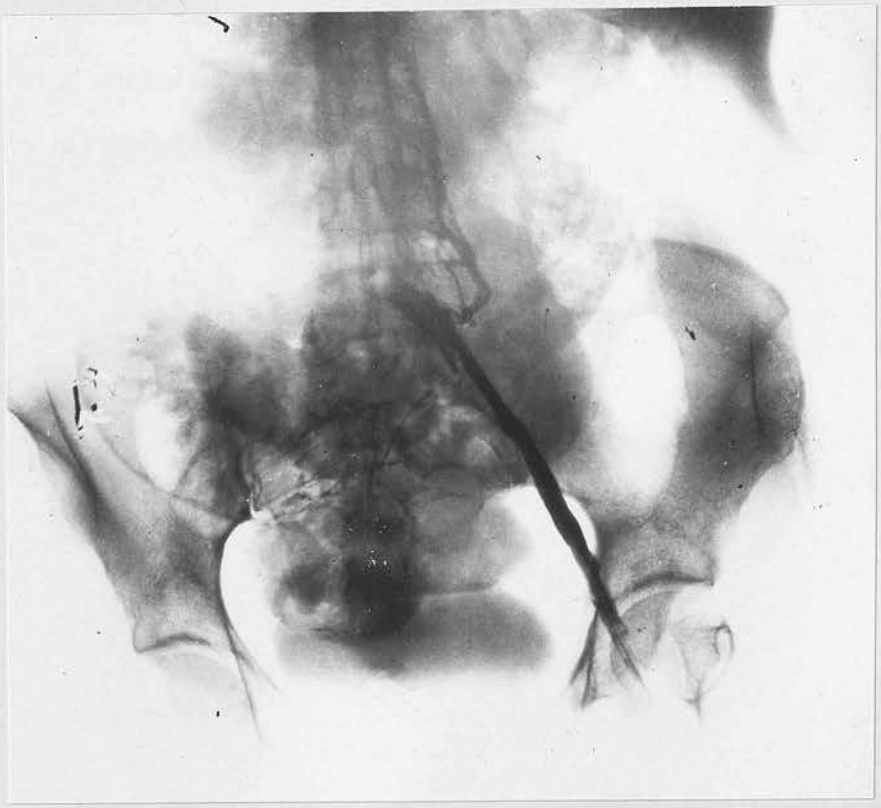
Legend to FIG. 22

Operative venograms during thrombectomy

(a) Early film - the internal iliac system is free of thrombus although there is thrombus in the external and common iliac vein.

(b) Late film - the external iliac vein has been cleared but common iliac occlusion persists. The internal iliac system is not filled.

a

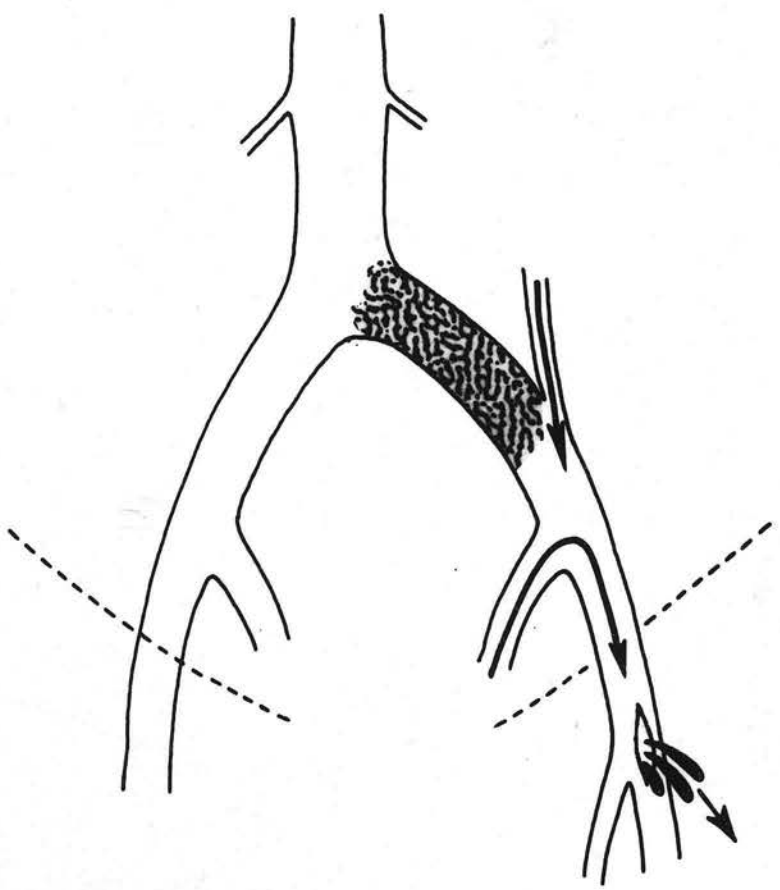


b

Legend to FIG. 23

"Bleed-back" at thrombectomy

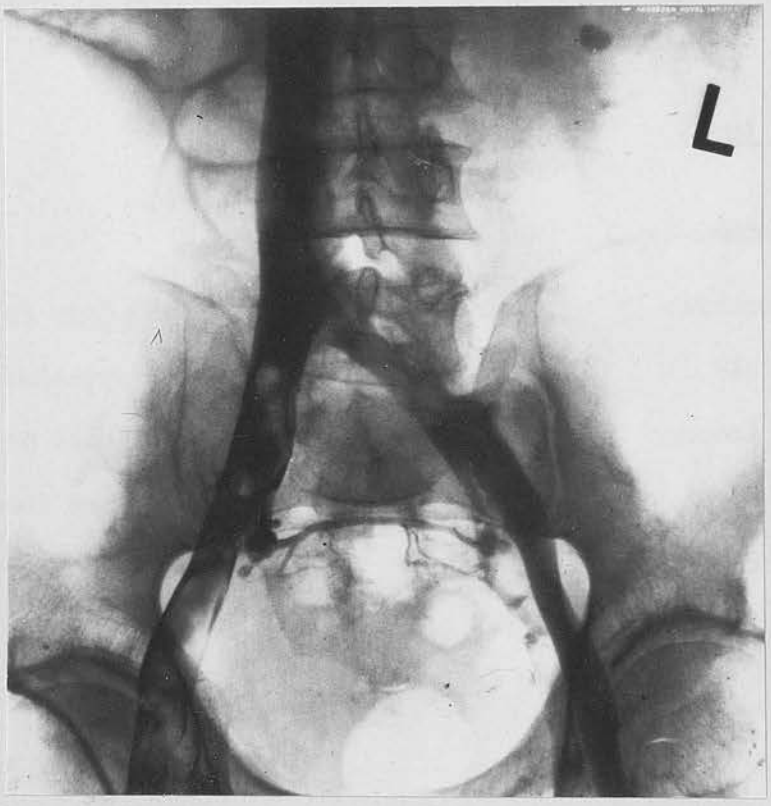
Diagrammatic representation of incomplete thrombectomy demonstrating how a good bleed-back can be obtained in such circumstances.



Legend to FIG. 24

Incomplete iliac thrombosis

Recurrent pulmonary embolism with "silent" legs in a 58 year old man. Bilateral femoral venography revealed right incomplete iliac thrombosis. (No collateral channels are seen - an indication that there is no venous insufficiency.) Patient was successfully treated by thrombectomy.


L

Legend to FIG. 25

Nature of thrombus in incomplete iliac thrombosis: thrombus removed from iliac vein at thrombectomy

(Same case as Fig. 24)

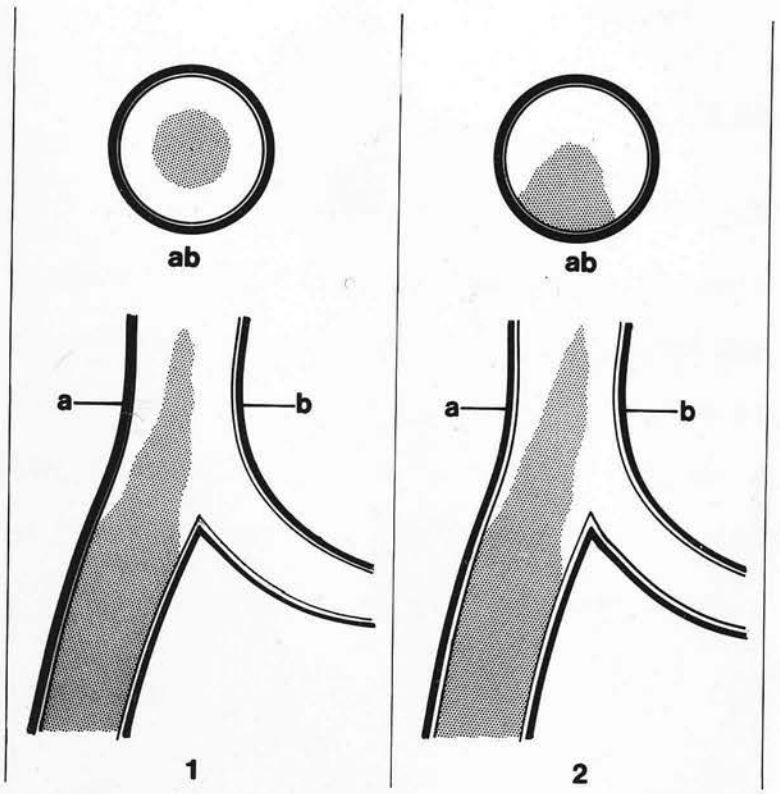
Old thrombus with more recent thrombus adherent to the surface. Fragments from the newer thrombus produced embolism.


1S
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21

Legend to FIG. 26

Thrombus propagation in veins - diagrammatic

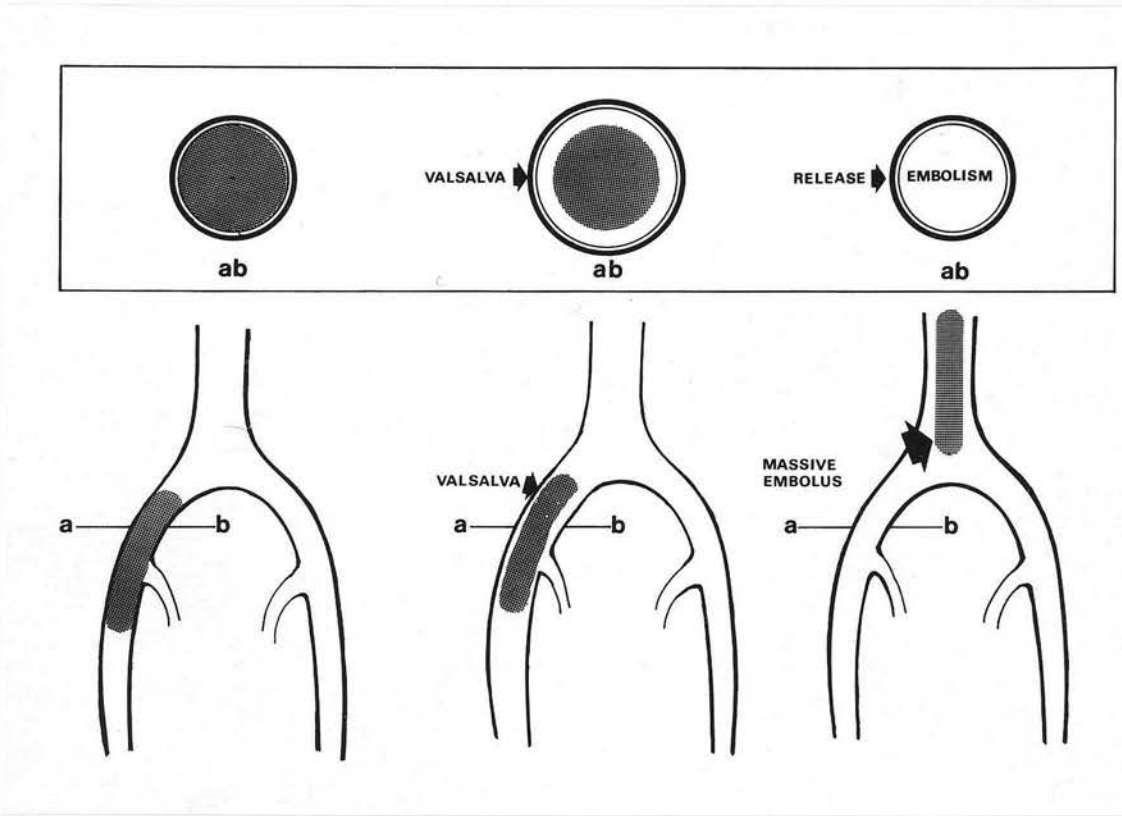
The use of terms such as "free-floating" thrombus (Homans) has led to the erroneous impression that extending thrombus is unattached (1). This is rare for thrombus is almost invariably adherent to the vein wall at one point at least (2), and the risk of this tail "breaking off" is not as great as the literature suggests.


ab
a
b
1
ab
a
b
2

Legend to FIG. 27

Embolus detachment by Valsalva manoeuvre

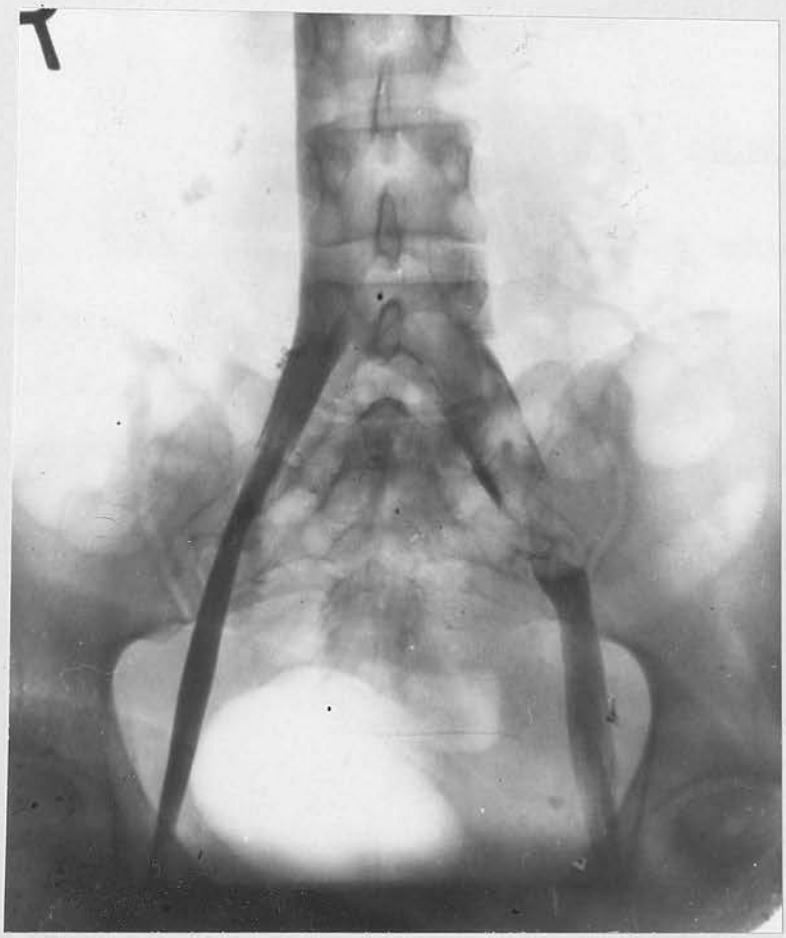
Arrest of venous flow during the Valsalva manoeuvre leads to venous distension (c.f. (1) and (2)) and this results in stripping of the thrombus from the venous wall shown in the transverse section. With the release of pressure the increased blood flow drives the thrombus towards the heart.


ab
VALSALVA
ab
RELEASE
EMBOLISM
ab
a
b
VALSALVA
a
b
MASSIVE
EMBOLUS
a
b

Legend to FIG. 28

Incomplete iliac thrombosis with leg symptoms

This 37 year old woman suffered pulmonary embolism 10 days after hysterotomy and tubal ligation. She had slight left calf discomfort and swelling with minimal increase in venous markings in the thigh. Bilateral venography revealed extensive non-occlusive thrombosis of the left upper segment. Patient was successfully treated by thrombectomy.


T

Legend to FIG. 29

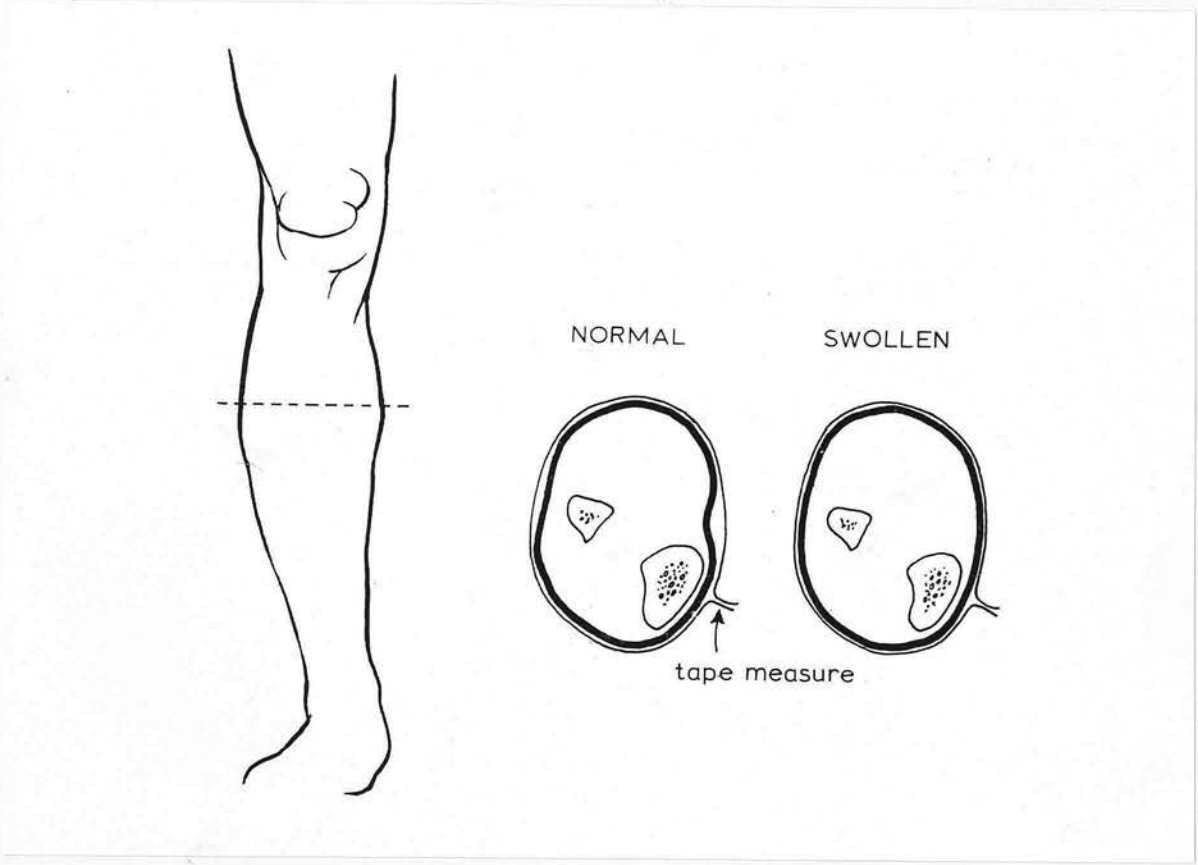
Post-thrombotic narrowing of the right common iliac vein

This 55 year old man developed leg pain and swelling, which settled rapidly with elevation, while in bed with diverticulitis 1 year previously. Since that time he had slight venous insufficiency in the form of leg tightness at the end of the day, and night cramps. Bilateral femoral venography showed marked narrowing of the right common iliac vein.

Legend to FIG. 30

Diagrammatic representation of errors in calf and thigh measurements

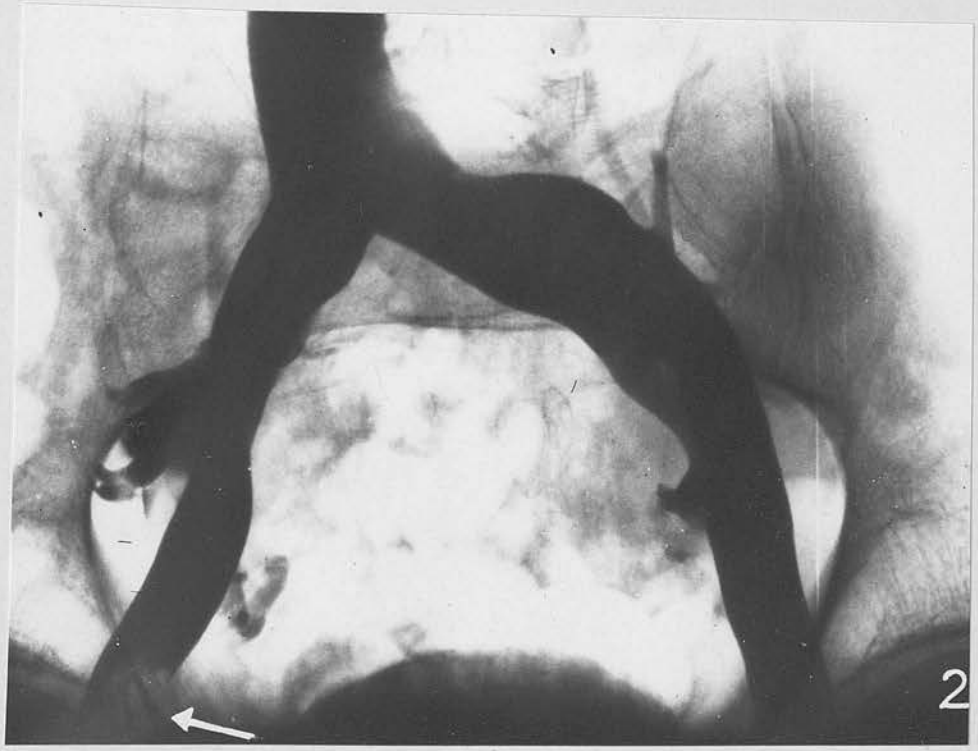
The hollow in the antero-medial aspect of the normal leg and thigh is the source of the error. (For full description see text page 49).


NORMAL
SWOLLEN
tape measure

Legend to FIG. 31

Saphenous Thrombophlebitis

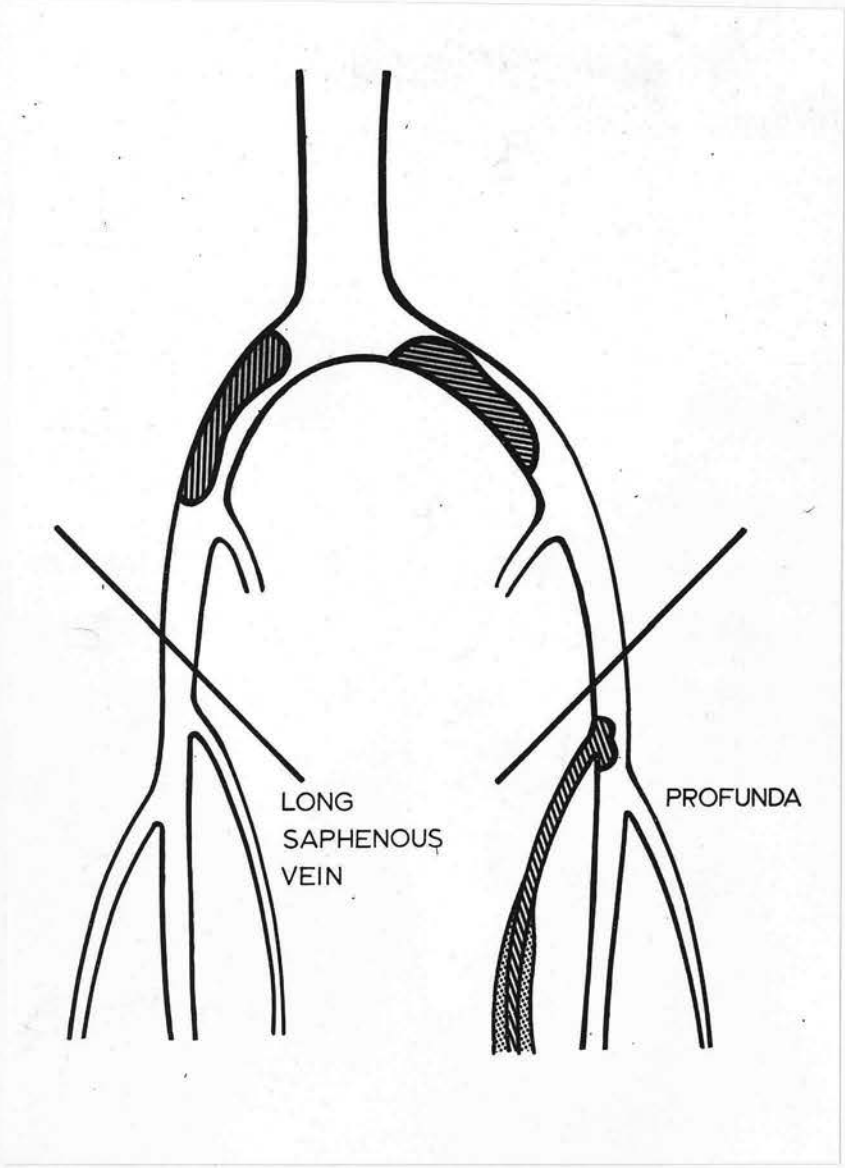
Bilateral femoral venogram in a man with saphenous thrombophlebitis without embolism. A filling defect in the common femoral vein due to thrombus projecting from the mouth of the saphenous is demonstrated. At emergency high saphenous ligation this plug of thrombus was extracted.


2

Legend to FIG. 32

Saphenous Thrombophlebitis

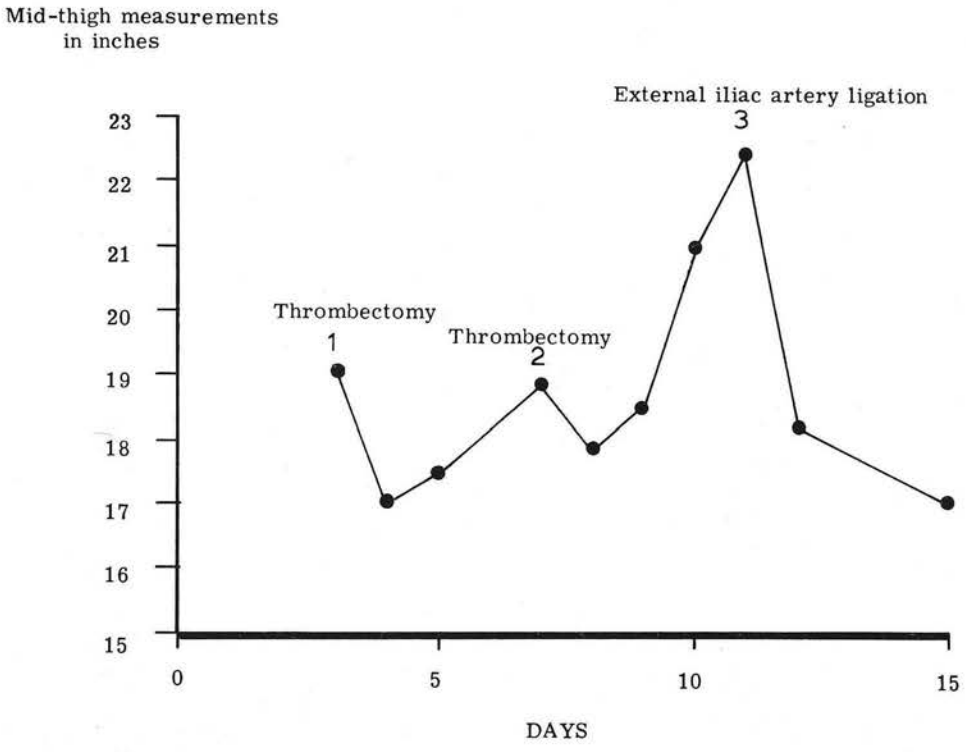
Diagrammatic representation of sites of iliofemoral venous thrombosis which may give rise to embolism in association with saphenous thrombophlebitis.


LONG
SAPHENOUS
VEIN
PROFUNDA

Legend to FIG. 33

Leg swelling in venous gangrene

The graph shows the variation in leg size measured at a constant point in the leg. The volume at 3 was 2460 mls. The reduction in size produced by thrombectomy, even though incomplete, is shown. External iliac artery ligation produced dramatic improvement.


Mid-thigh measurements
in inches
23
22
21
20
19
18
17
16
15
External iliac artery ligation
3
Thrombectomy
1
Thrombectomy
2
0
5
10
15
DAYS

Legend to FIG. 34

Bilateral venous gangrene

Case 2 (Appendix IV) - 72 year old woman.

The extensive bilateral gangrene is typical. The right leg is swollen and shows other evidence of venous insufficiency. The left leg is not swollen but external iliac artery ligation had been carried out on this side.

Legend to FIG. 35

Venous gangrene - Autopsy

Case 2 (Appendix IV) - same case as Fig. 34.

Two sections of I.V.C. and aorta, one upper abdomen, the other lower. The inferior vena cava is occluded at both levels while the aorta is fairly healthy. The venous system was shown to be occluded throughout the lower limbs, while the arteries were patent.


PM
110 | 55

Legend to FIG. 36

Venous Gangrene

Case 5 - 43 year old man

There is gangrene of the toes and skin of dorsum of the foot. This photograph was taken 10 days after thrombectomy and the leg is no longer swollen or cyanosed. The tips of the toes separated with conservative care.

Legend to FIG. 37

Venous Gangrene

Case 5 - 43 year old man

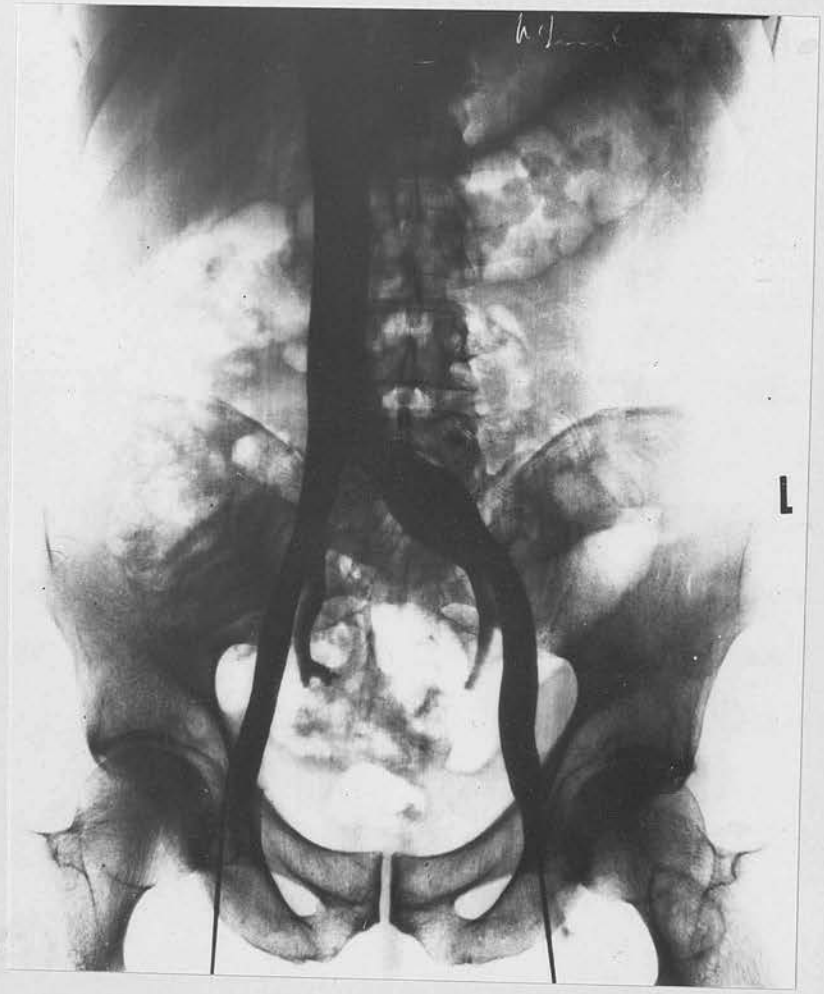
There is gangrene of the skin over the calf and most of the gastrocnemius muscle is necrotic. This photograph was taken late in the disease when separation was advanced.

Legend to FIG. 38

Venous Gangrene - Follow-up venogram after caval thrombectomy

Case 5

A 43 year old man with bilateral venous gangrene, treated by caval thrombectomy with dramatic improvement. Follow-up venogram 2½ years later shows completely normal iliofemoral segments. This patient had no venous insufficiency.


L

Legend to FIG. 39

Impending venous gangrene

This 54 year old man developed an extensive left iliofemoral venous thrombosis after resection of a colonic carcinoma. The leg was intensely blue. The leg was cold to the knee and sensation was absent over the foot and diminished to knee level. There was hypotension (B.P. 86/50) due to sequestration of fluid in the leg. Photography ½ hour before thrombectomy.

Legend to FIG. 40

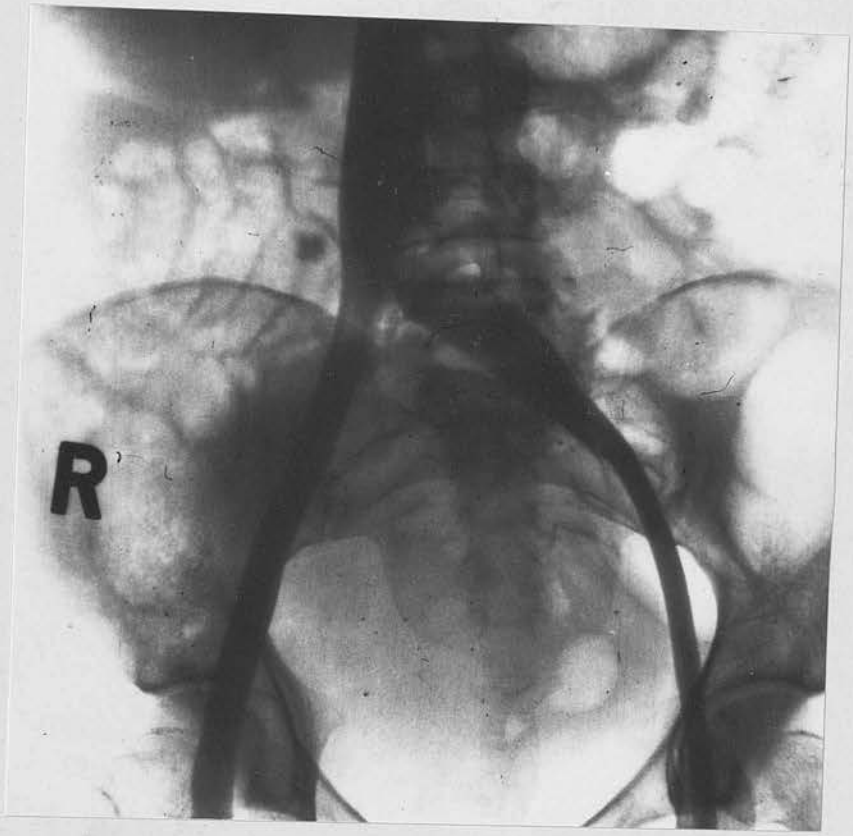
Response to thrombectomy

Same case as Fig. 39. 12 hours after thrombectomy showing dramatic decrease in the size of the limb, and improvement in colour. Warmth and sensation had returned to the limb.

Legend to FIG. 41

Normal iliofemoral venograms

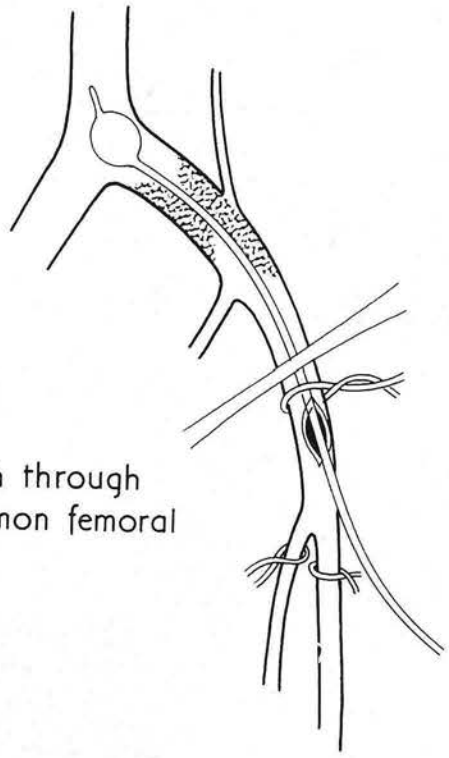
A 31 year old woman with suspected venous gangrene had bilateral femoral venograms carried out. As these were normal conservative care was continued and anticoagulant drugs discontinued with rapid resolution of symptoms and signs.


R

Legend to FIG.42

Diagrammatic representation of thrombectomy via the common femoral vein.

ILIO-FEMORAL VENOUS THROMBECTOMY



Approach through
the common femoral

Legend to FIG. 43

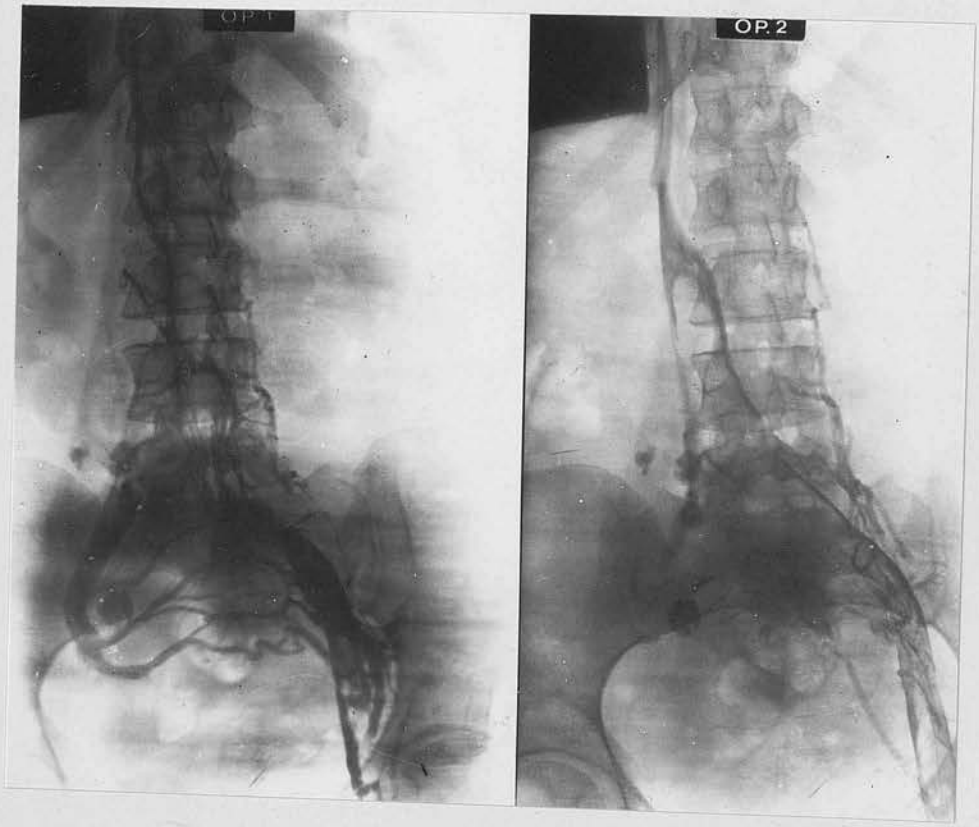
Progress of thrombectomy under venographic control

(a) Early film showing complete common iliac occlusion with marked cross circulation.

(b) A small channel has been established through the common iliac vein.

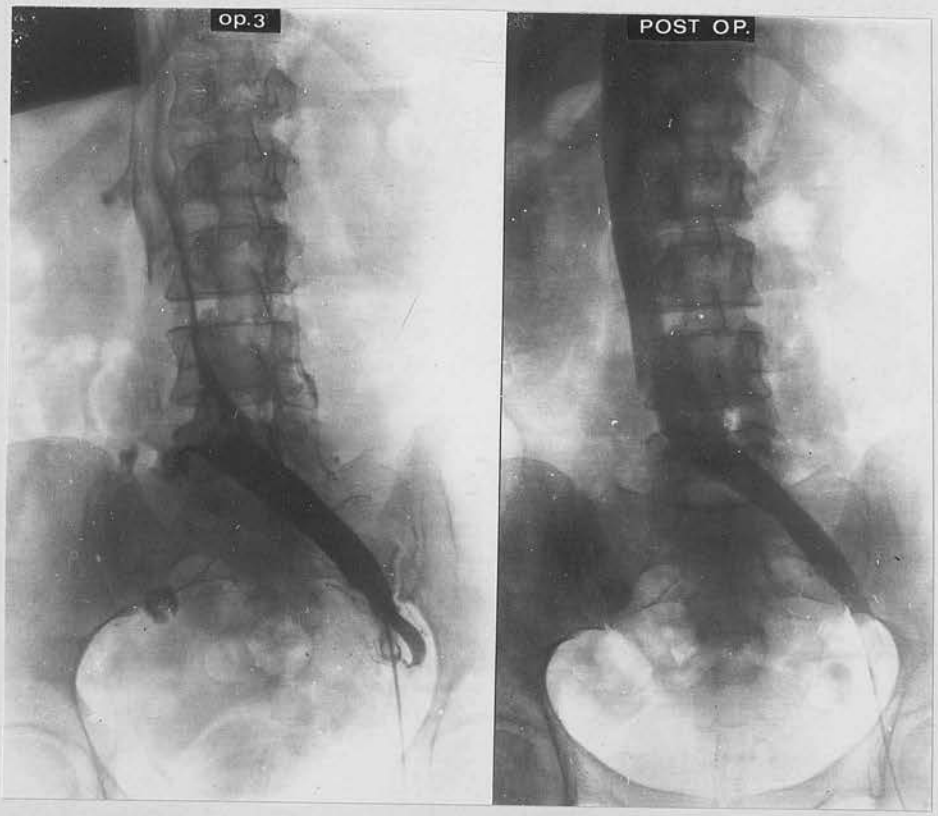
(c) The iliacs are clear but thrombus persists in the inferior vena cava.

(d) This post-operative venogram, which is identical to the final operative film shows complete clearance of the iliac veins and the inferior vena cava. Collateral channels no longer fill.



a

b



c

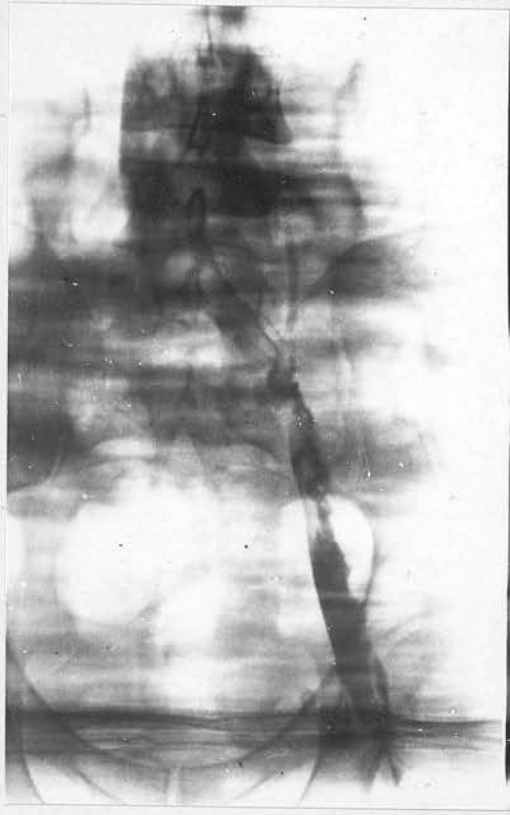
d

Legend to FIG. 44

Thrombectomy under venographic control

A 34 year old man with a traumatic paraplegia developed an extensive iliofemoral thrombosis associated with pulmonary embolism 2 weeks after his injury. Venous thrombectomy was carried out. In (a) there is considerable residual thrombus which was removed before the final operative film (b). Complete clearance was maintained as shown in (c), the venogram on the 11th postoperative day.

a



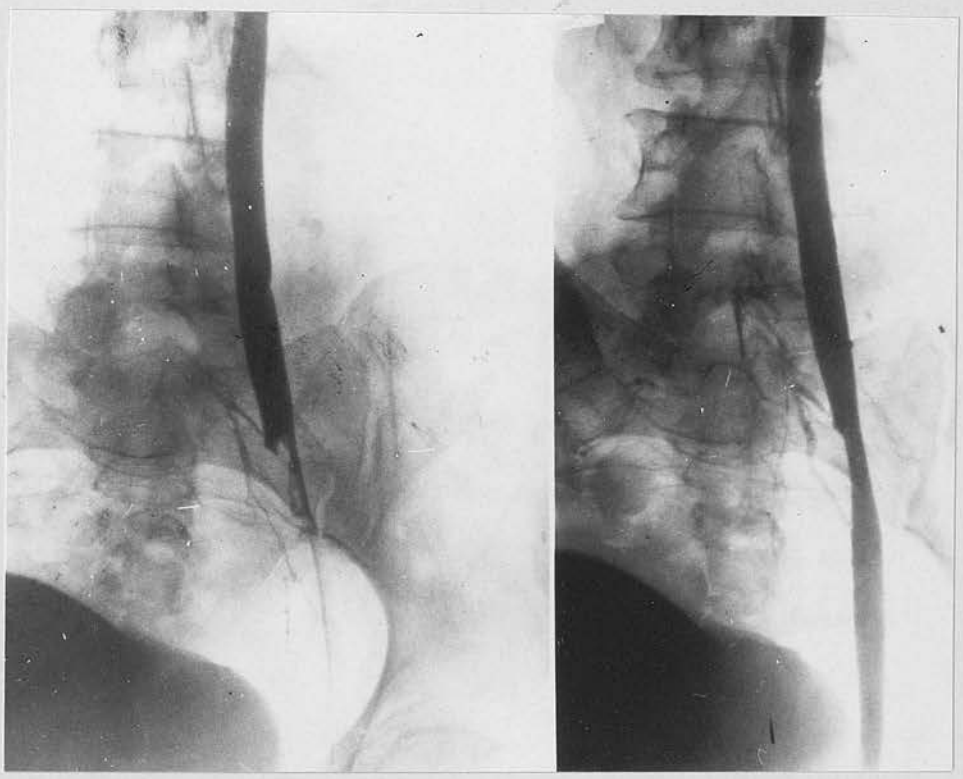
b

c

Legend to FIG. 45

Thrombectomy under venographic control

Spontaneous iliofemoral venous thrombosis in a 54 year old female. (a) Venogram taken after removal of a large quantity of thrombus. Note persisting thrombus in the external iliac vein. There is a left sided inferior vena cava. (b) Venogram taken just prior to suturing the vein. Clearance of the iliofemoral system is complete.



a b

Legend to FIG. 46

Additional radiographic aid in thrombectomy

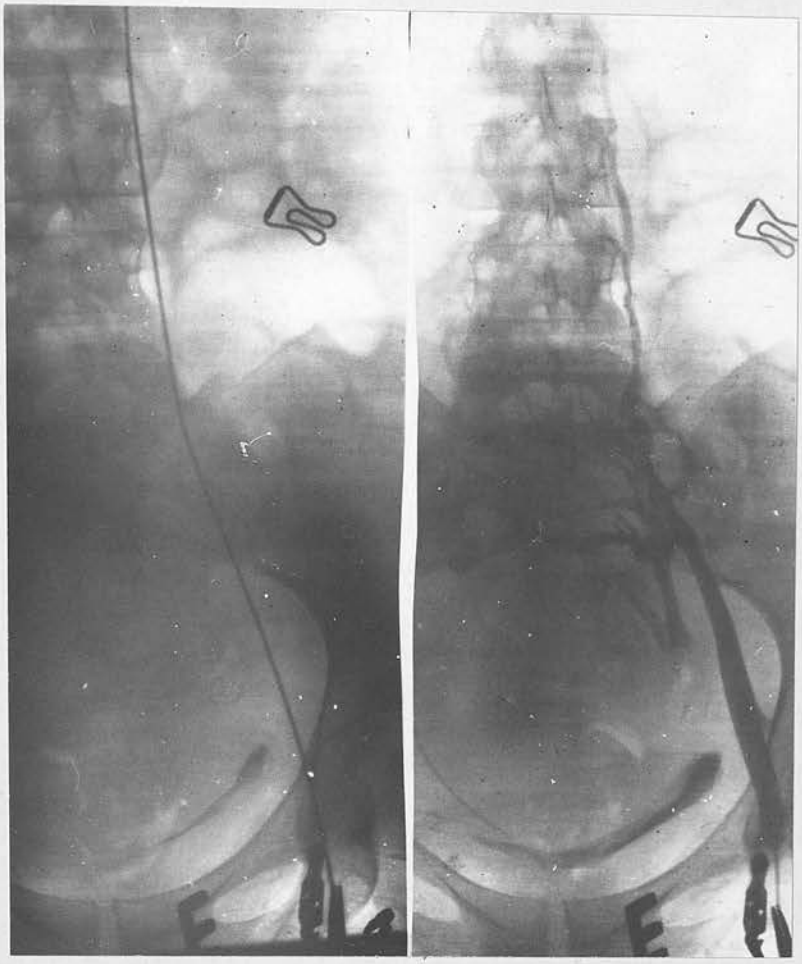
Post-operative iliofemoral venous thrombosis in a 26 year old female. The Fogarty catheter has been passed to the vena cava and the bag inflated with 60% urografin. The catheter has been withdrawn until it impacted at the mouth of the common iliac vein and the film exposed. The catheter has clearly traversed the left common iliac vein and the balloon is in the inferior vena cava. This indicates the upper limit of thrombosis, and by comparison with venograms, aids the assessment of the extent of residual thrombus.

Legend to FIG.47

Fogarty catheter deflected up ascending vein

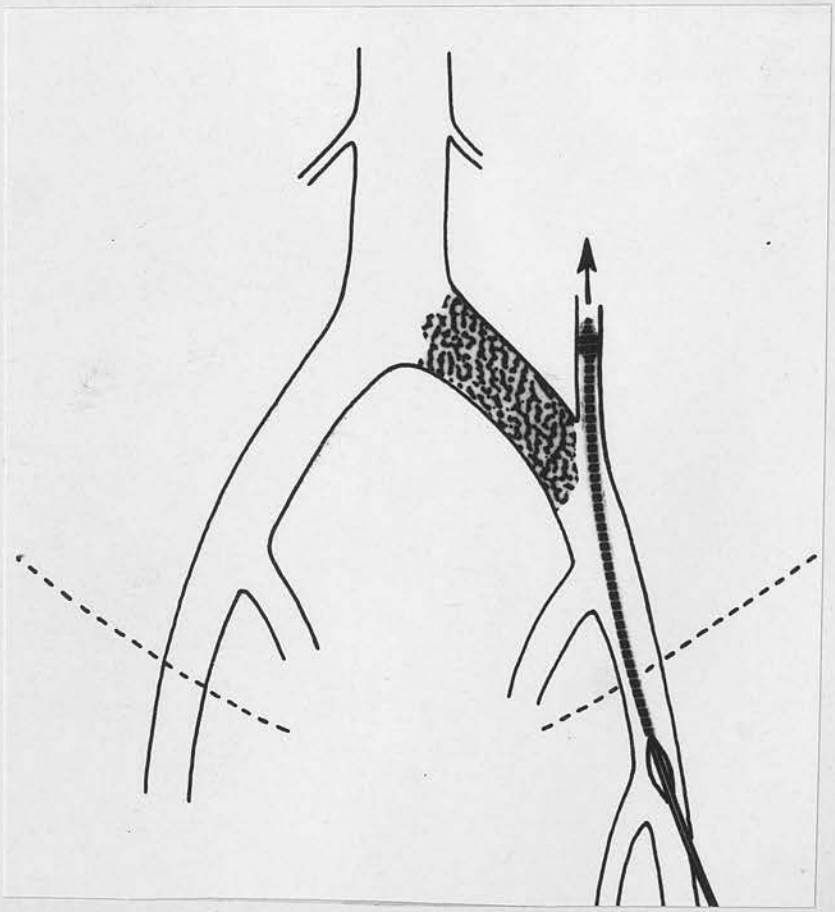
Post-partum iliofemoral venous thrombosis in a 32 year old female. The Fogarty catheter has been deflected up the ascending lumbar vein (a). Common iliac occlusion persists (b). Diagrammatic representation of this situation. This illustrates how estimation of clearance, based on the length to which a catheter can be inserted, can be incorrect.

a



b

c



Legend to FIG. 48

Thrombectomy under venographic control

Left iliofemoral venous thrombosis at 38th week of pregnancy in a 22 year old female. The patient was delivered by caeserian section and left femoral thrombectomy was then performed.

(a) Early film during thrombectomy

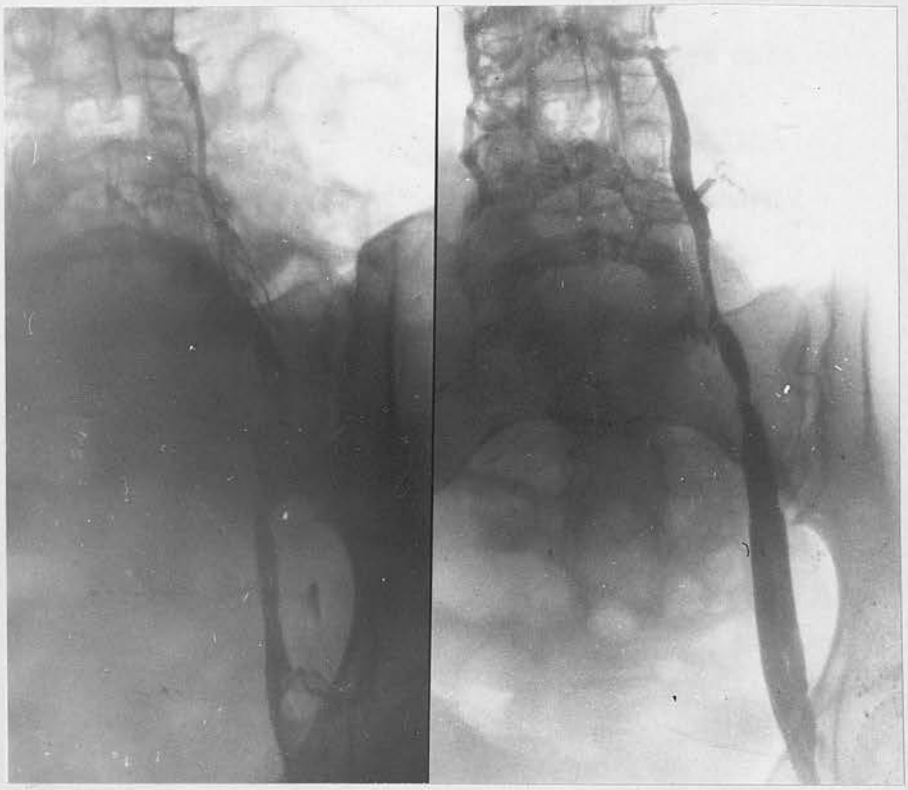
Note (1) common iliac vein is occluded.

(2) the ascending lumbar vein is filling through small tributaries only.

(3) the external iliac vein contains thrombus.

(b) Venogram just prior to suturing the vein

It was impossible to clear the left common iliac vein. Although the Fogarty catheter could be inserted to 35 cm. it repeatedly passed up the ascending lumbar vein. The large direct collateral channel provided by the ascending lumbar vein is apparent. (c.f. Fig. 45 where there was a left-sided inferior vena cava.)

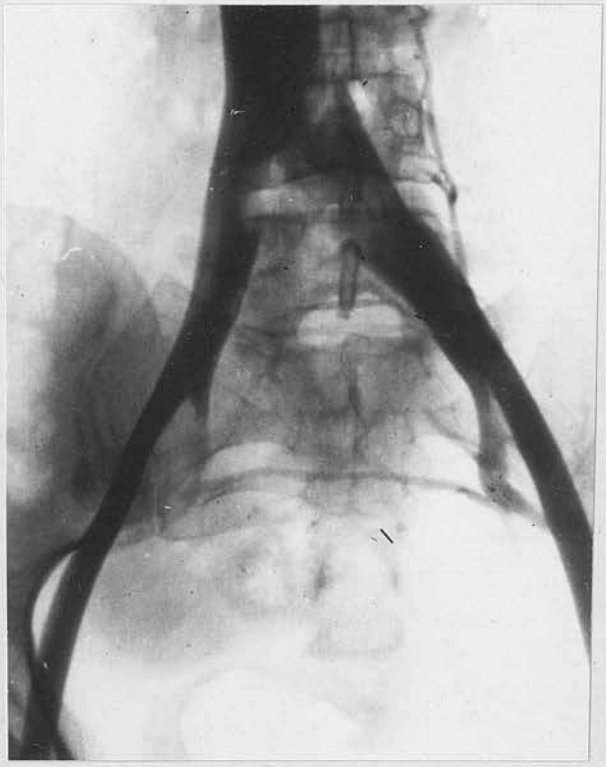


a b

Legend to FIG. 49

Normal iliofemoral venogram

A 25 year old woman $2\frac{1}{2}$ years after right venous thrombectomy. Both iliofemoral segments are clear. The distinct notch produced by the overlay of the right common iliac artery on the left common iliac vein is apparent. The absence of collateral channels confirms that there is no venous obstruction.



Legend to FIG. 50

Normal iliofemoral venogram

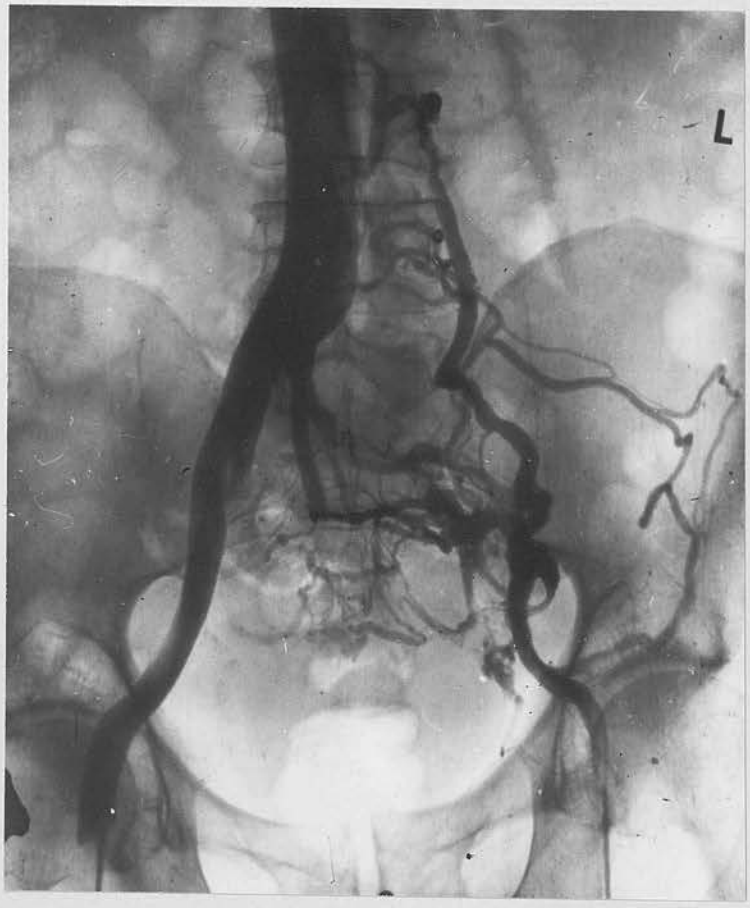
The potential collateral channels are not demonstrated.


L

Legend to FIG. 51

Direct collateral channels of the iliofemoral segment

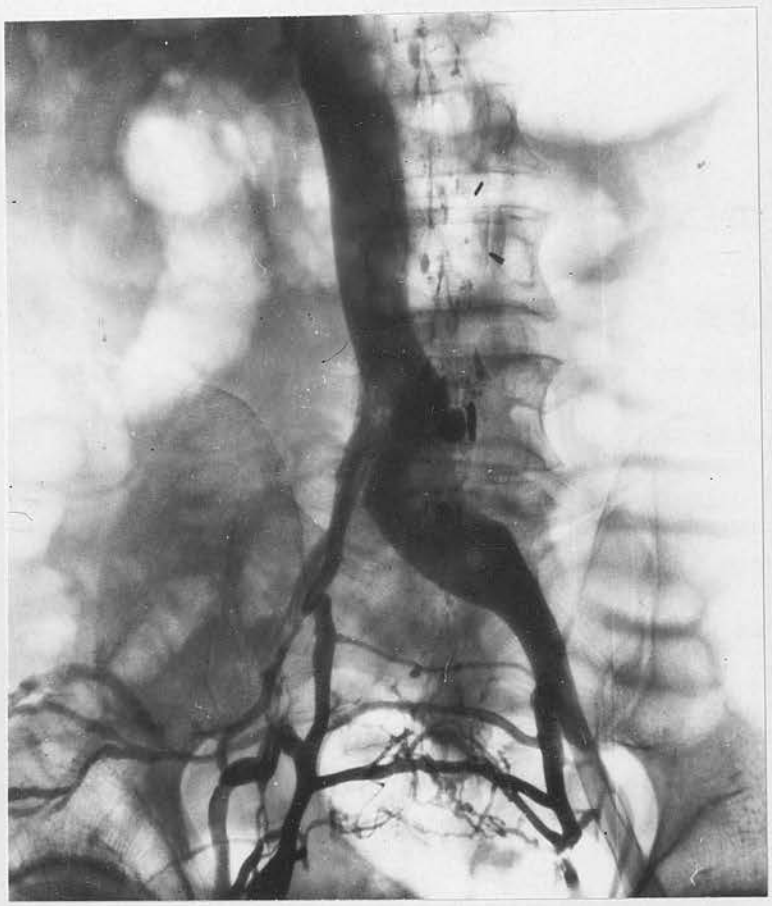
A 68 year old man. Venography 4 years after venous thrombectomy. He had minimal venous insufficiency with subjective symptoms mainly cramp but without clinical signs of swelling or increased venous markings. The main channel shown is a large ascending lumbar vein.


L

Legend to FIG. 52

Iliac venae comitantes

A 52 year old man with postoperative right iliofemoral thrombosis treated conservatively. Venography 10 months later shows that the main drainage is by way of the internal iliac vein to common iliac venae comitantes. He had moderate symptoms without signs of venous insufficiency.



Legend to FIG. 53

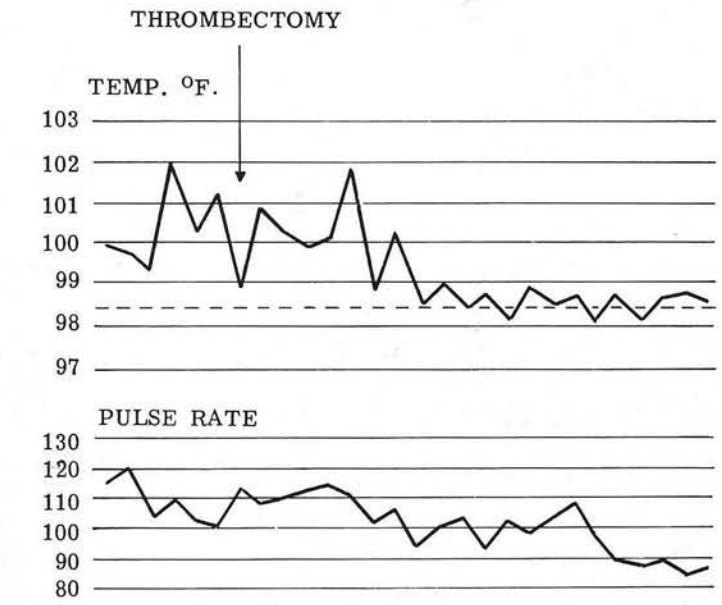
Arrest of the thrombophlebitic process by thrombectomy

A 40 year old man with postoperative iliofemoral venous thrombosis.

Temperature and E.S.R. settled rapidly following thrombectomy.

G. McC AGED 40 ADMITTED 24.9.60

DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14



E.S.R. (mm. FALL)

80		82	94	90	60	32	40	38	32	30	32	20	22

CALF (cm.)

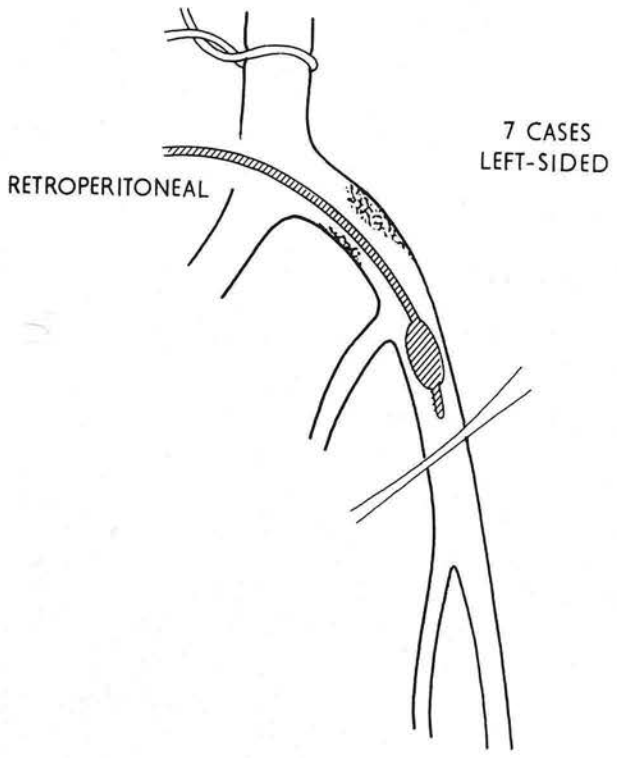
RIGHT	32	32·5		29·5									
LEFT	32	32·5		30									

Legend to FIG. 54

Diagrammatic representation of thrombectomy via the inferior vena cava.

ILIO-FEMORAL VENOUS THROMBECTOMY

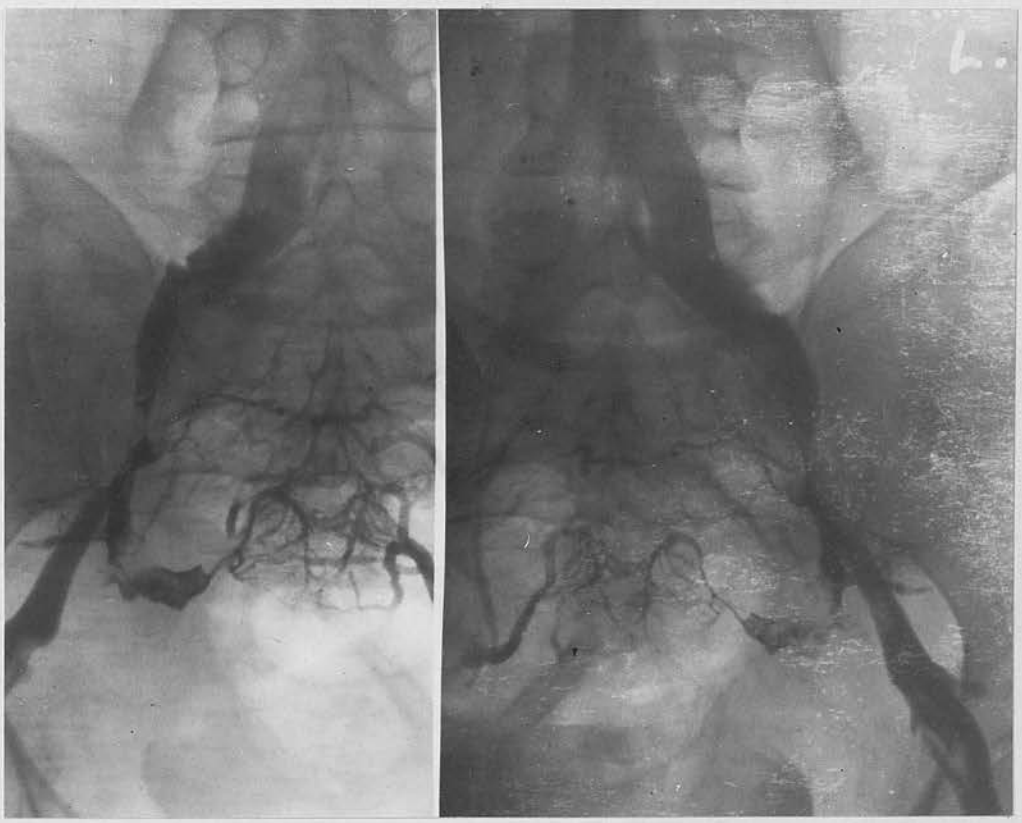
Approach from the cava



Legend to FIG. 55

Iliofemoral thrombosis on iliac kinking

A 66 year old woman with carcinoma of uterine body had radium followed by total hysterectomy and bilateral salpingo-oophorectomy carried out by the vaginal route so that pelvic floor repair could be undertaken at the same time. The ovaries were adherent to the lateral pelvic walls and there was considerable difficulty in removing them. Despite prophylactic anticoagulants the patient developed a right iliofemoral venous thrombosis. Final operative venogram (a) showed considerable narrowing at the termination of the external iliac vein. Two months later she developed a left iliofemoral thrombosis. Again the final operative venogram (b) showed narrowing at the same point. On both sides the narrowing is extraluminal and was thought to result from the pull of the ligated infundibulo-pelvic ligaments. (c.f. Fig. 56.)



a b

Legend to FIG. 56

Iliac "kinking" during pregnancy

A 26 year old primipara developed a severe right phlegmasia caerulia dolens in the 32nd week of gestation. At thrombectomy no clot was found and venography showed almost complete occlusion at the termination of the external iliac vein (a). As this had disappeared on venography 2 weeks after delivery (b) it was interpreted that the "kinking" was the result of pull of the gravid uterus on the broad ligament.

a

b

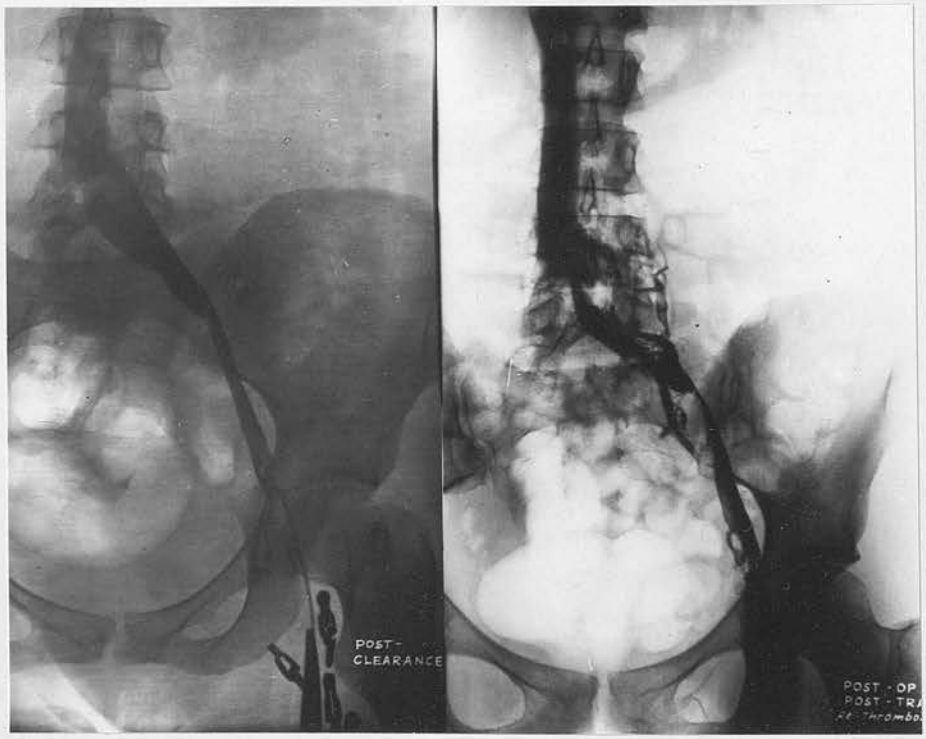
Legend to FIG. 57

Postoperative rethrombosis following blood transfusion

A 25 year old woman developed left iliofemoral venous thrombosis while undergoing treatment for ulcerative colitis.

(a) Thrombectomy resulted in complete clearance which was maintained in the early postoperative stage.

(b) Symptoms recurred 24 hours after an infusion of 4 units of whole blood and venography revealed extensive rethrombosis.

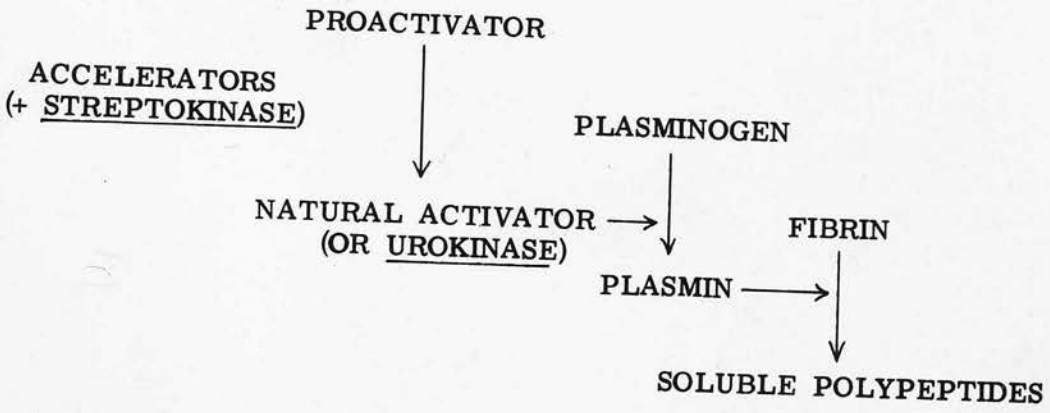


a b

Legend to FIG. 58

Fibrinolysis (schematic)

SCHEME OF FIBRINOLYSIS

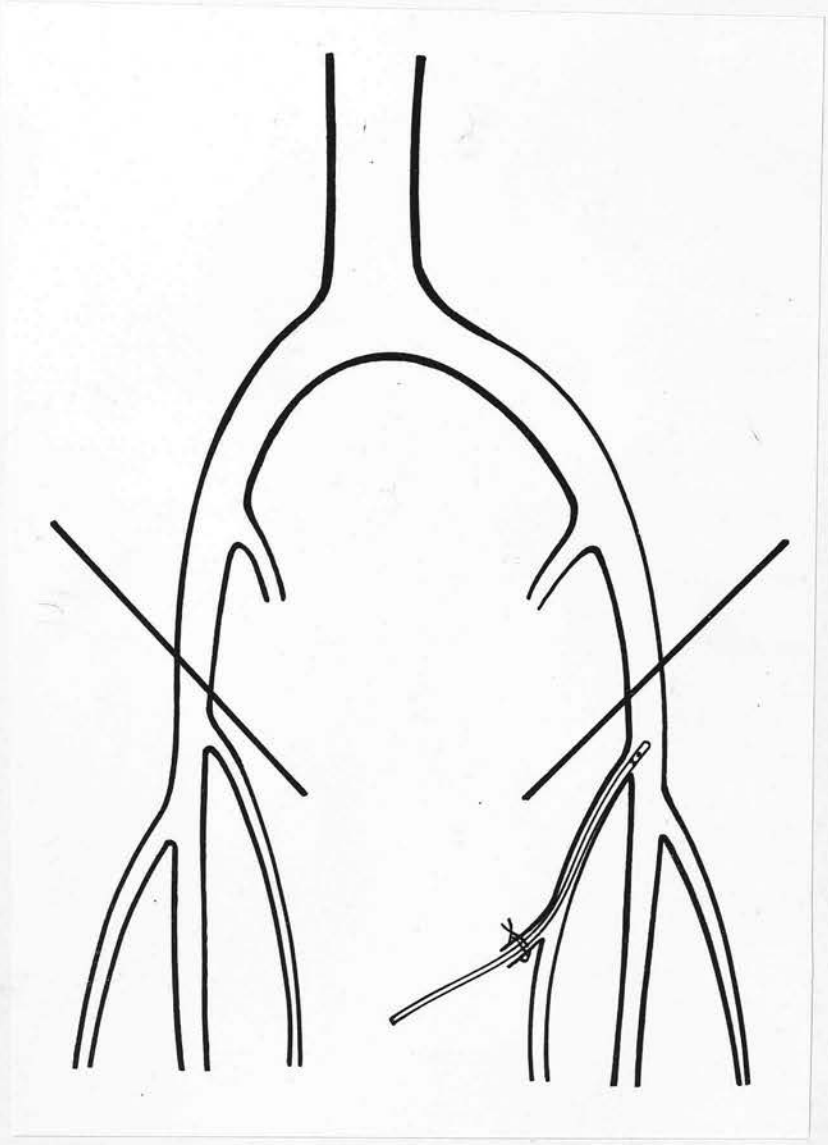


Legend to FIG. 59

Sapheno-femoral infusion (diagrammatic)

The tip of the catheter is at the sapheno-femoral junction.

This catheter is used for plasminogen activators or heparin saline infusions and for postoperative venography.



Legend to FIG. 60

Urokinase for residual thrombus after thrombectomy

Case 1 - 24 year old woman

(a) Final operative venogram

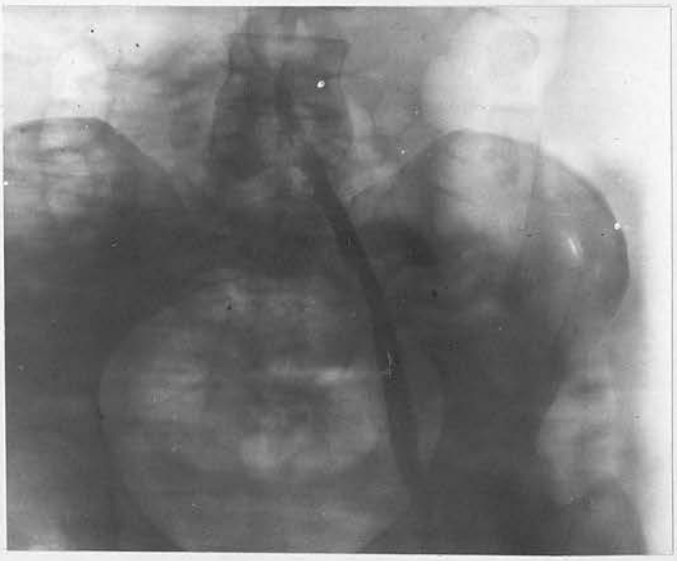
The external iliac vein is clear but mural thrombus persists in the common iliac vein.

(b) Venogram after 30 mins. urokinase

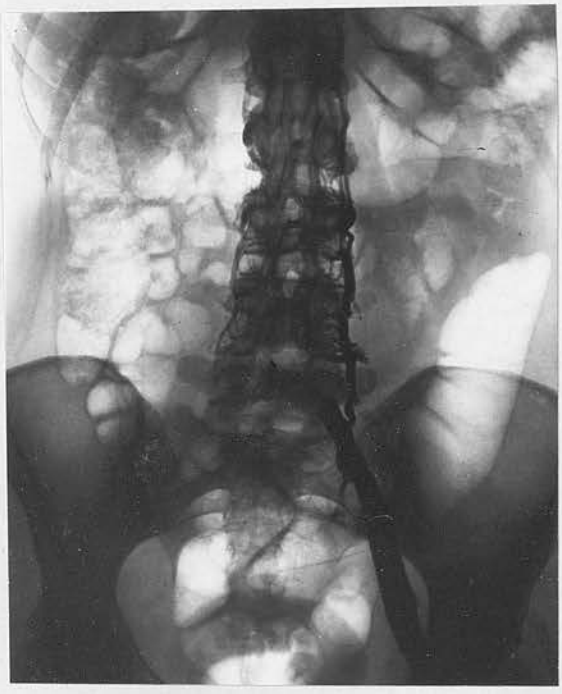
The common iliac thrombosis has progressed to occlusion.

(c) Venogram after urokinase

Considerable lysis has occurred. There is now a channel through the common iliac vein, but there is persisting mural thrombus.



a



b

c

Legend to FIG. 61

Urokinase in post-thrombectomy rethrombosis

Case 5 - 24 year old woman

(a) Final operative venogram

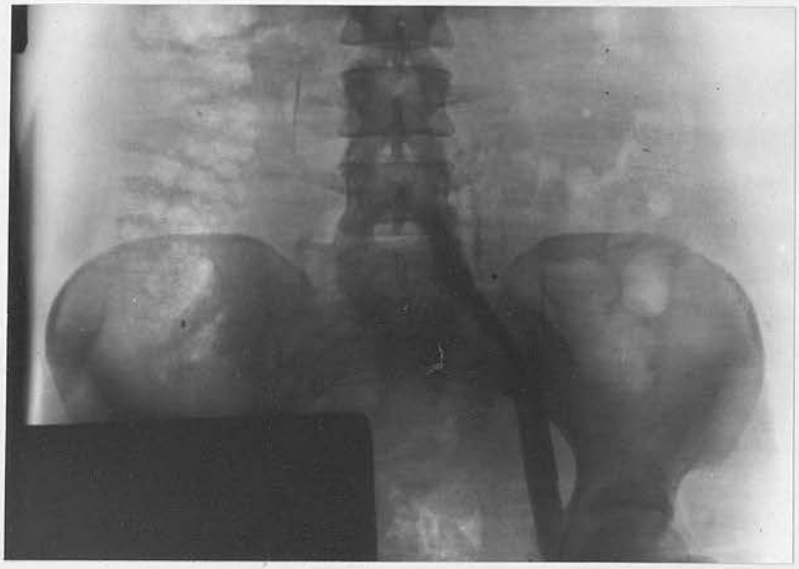
Clearance is almost complete, although a little mural thrombus persists in the common iliac vein.

(b) Venogram after 3½ hours of urokinase

Common iliac thrombus has increased and considerable thrombus surrounds the catheter in the external iliac vein.

(c) Venography 2 days after stopping urokinase

The iliofemoral segment is completely clear.



a

b

c

Legend to FIG. 62

Urokinase in post-thrombectomy rethrombosis

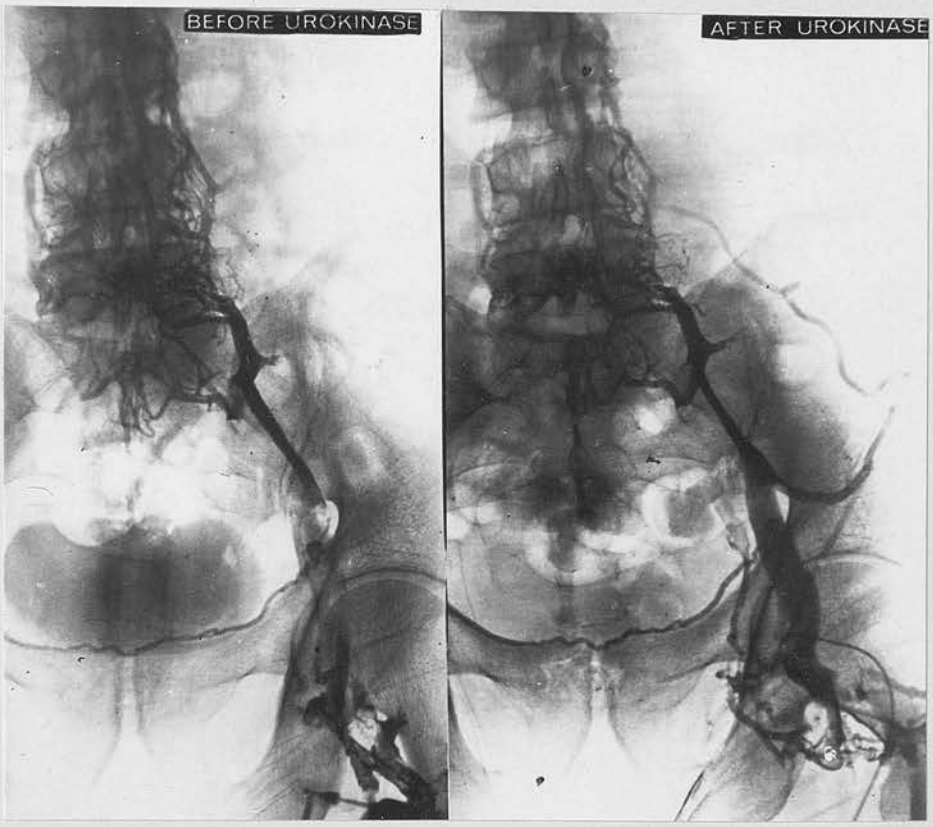
Case 7 - 56 year old woman

(a) Venogram on 9th day after thrombectomy

Complete common iliac occlusion, present since operation, is apparent, and there is a large filling defect in the external iliac vein due to thrombus.

(b) Venogram days after urokinase

The common iliac occlusion persists but the external iliac vein has been completely cleared of thrombus.



a b

Legend to FIG. 63

Urokinase in post-thrombectomy rethrombosis

Case 8 - 43 year old man

(a) Venogram on 3rd day after thrombectomy

There is common iliac obstruction and considerable mural thrombus present in the external iliac vein.

(b) Venogram 8 hours after urokinase

There is now a channel through the common iliac vein, but mural thrombus persists in both the external and common iliac veins.

a b

Legend to FIG. 64

Urokinase in post-thrombectomy rethrombosis

Case 9 - 25 year old woman

(a) Final operative venogram showing complete clearance.

(b) Venogram 12 hours after infusion of 4 units of whole blood showing marked rethrombosis.

(c) Venogram 12 hours after (b) showing that rethrombosis is more extensive.

(d) Venogram 48 hours after urokinase showing considerable, though incomplete lysis of thrombus.

a b

c d

Legend to FIG. 65

Urokinase in post-thrombectomy rethrombosis

Case 10 - 48 year old woman

(a) Venogram 3 days after thrombectomy

There is complete occlusion of the iliofemoral segment with filling of collateral channels.

(b) Venogram after urokinase

Considerable thrombolysis has occurred, although the segment has not been cleared, and collaterals persist.

a

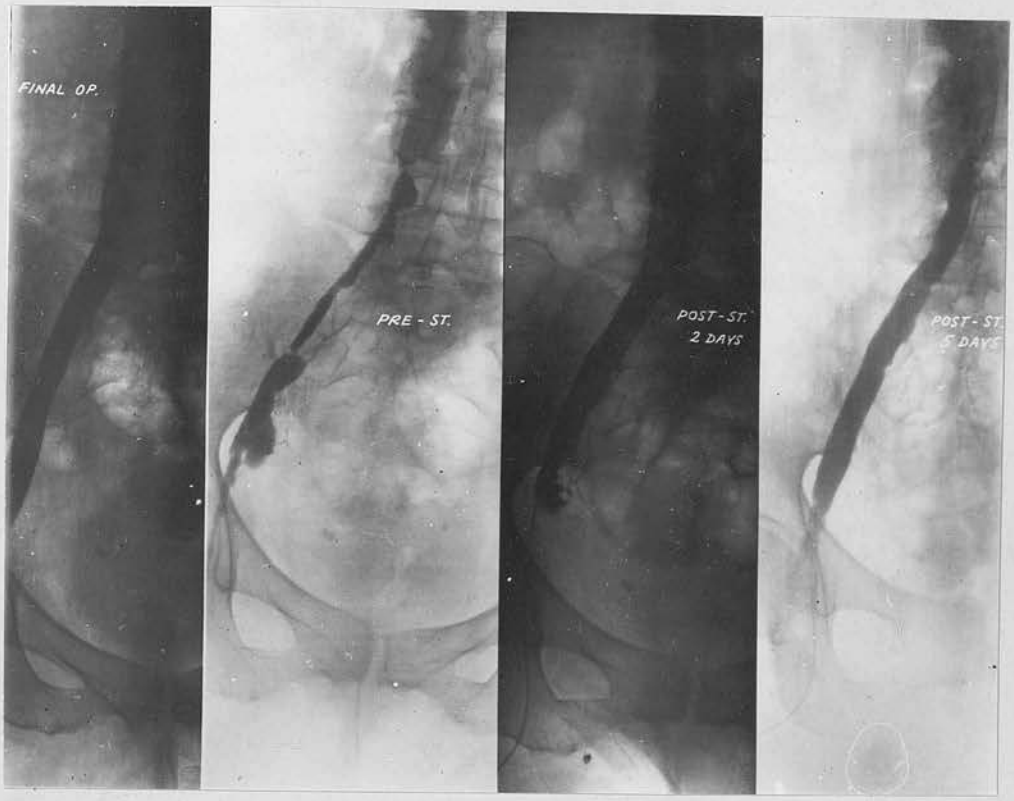
b

Legend to FIG. 66

Streptokinase in post-thrombectomy rethrombosis

Case 1 (Appendix VI)

A 79 year old woman with a left iliofemoral venous occlusion of 57 years duration developed an occlusive right iliofemoral venous thrombosis with incipient venous gangrene. At right femoral thrombectomy the iliacs were cleared but a non-occlusive plug of thrombus was left at the caval confluence (a). Extensive rethrombosis occurred over the next 5 days (b). Streptokinase infusion resulted in extensive lysis until the iliacs and cava were free of thrombus, including the plug present at completion of thrombectomy (c). Venography at 5 days showed that extensive caval thrombus had reformed (d).



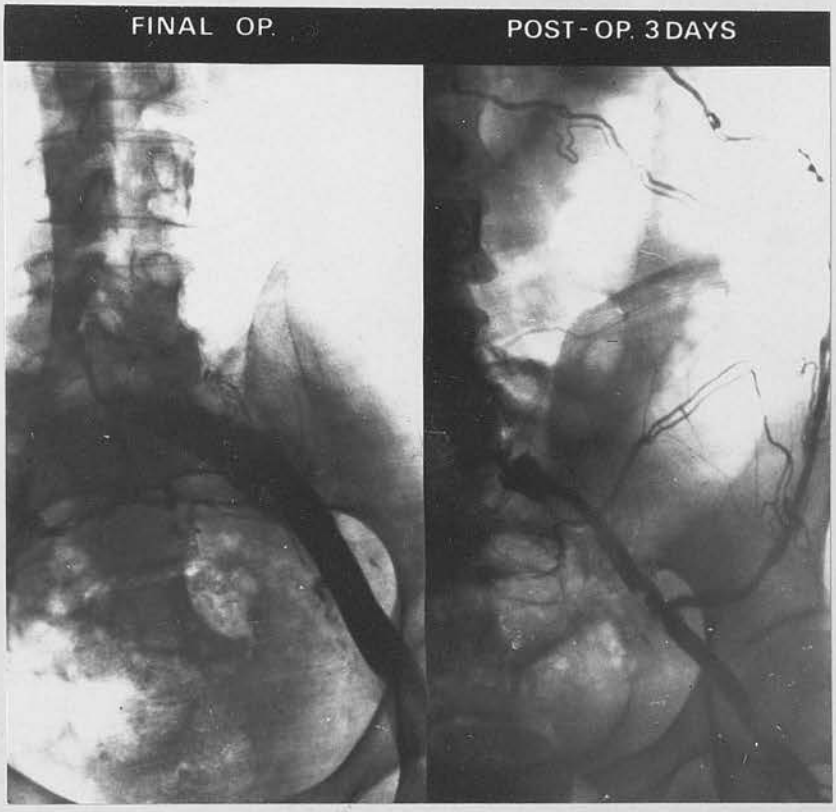
a b c d

Legend to FIG. 67

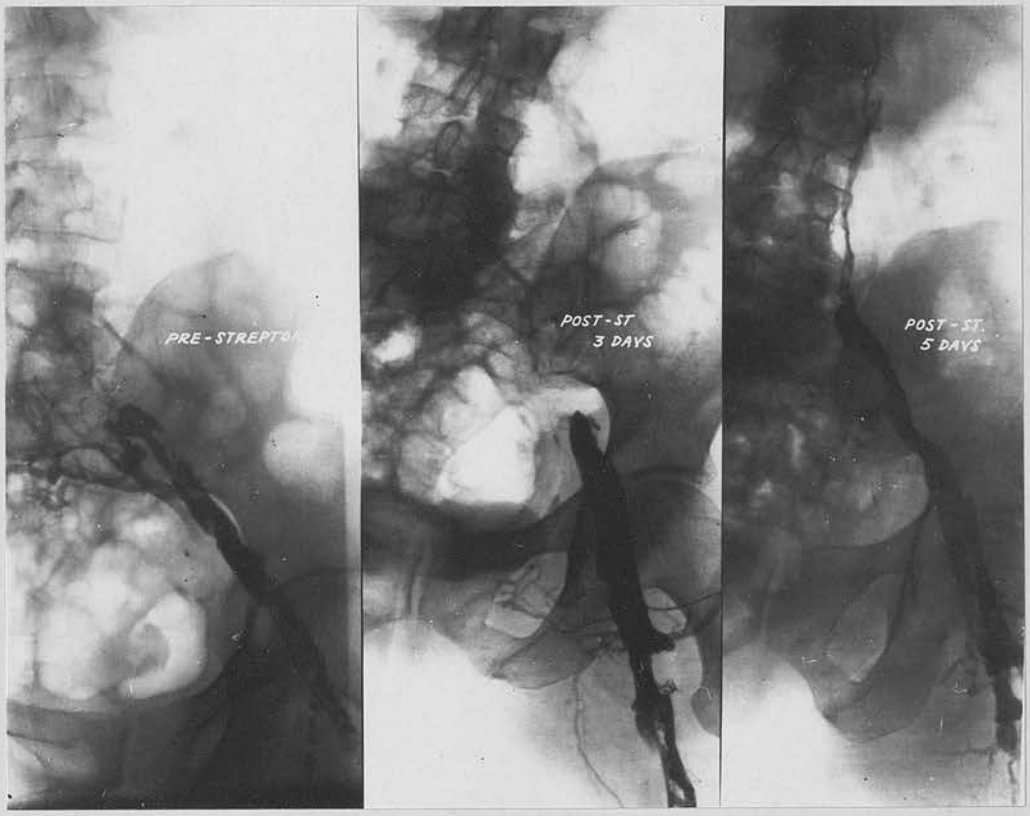
Streptokinase in post-thrombectomy rethrombosis

Case 2 (Appendix VI).

A 63 year old woman presented with a spontaneous extensive left iliofemoral occlusive thrombosis of 3 days duration. At thrombectomy clearance of the common iliac vein was incomplete (a) and rethrombosis with occlusion of this vessel resulted (b). After a delay of 12 days, streptokinase was administered and (c), (d) and (e) show the progress of lysis to open the ascending lumbar collateral. The infusion was discontinued 2 days before the venogram at (d) and 4 days before (e), indicating that lysis continued long after the infusion was discontinued.



a b



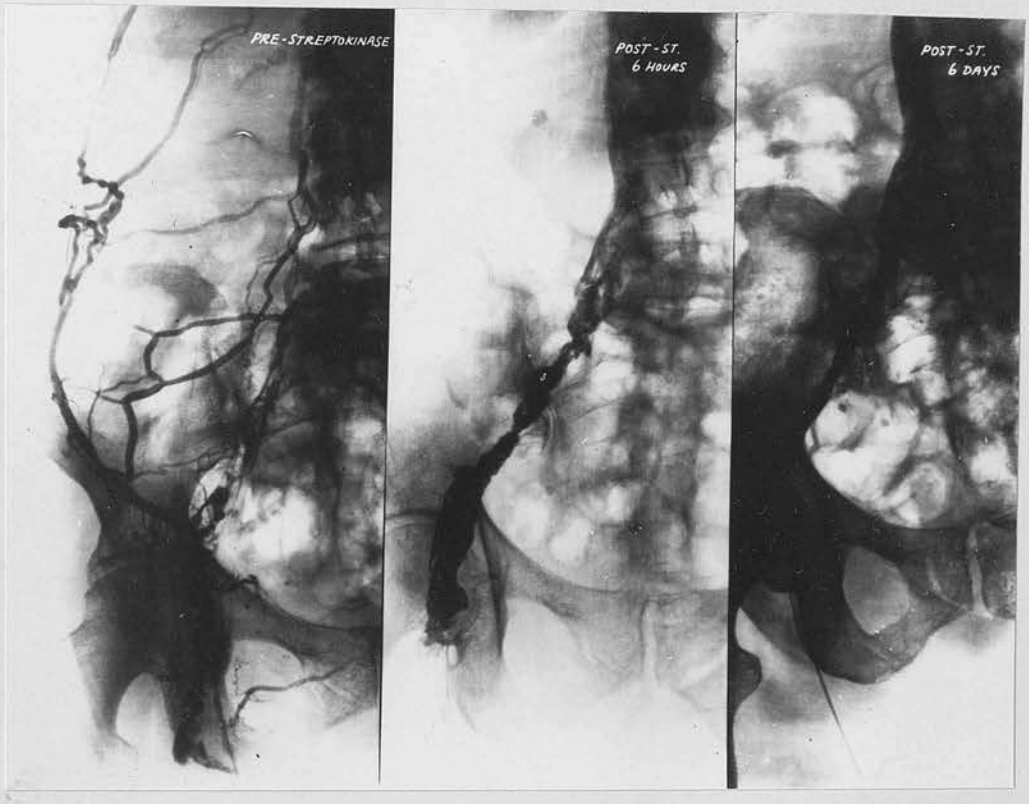
c d e

Legend to FIG. 68

Streptokinase in post-thrombectomy rethrombosis

Case 3 (Appendix VI)

Extensive occlusive rethrombosis occurred 6 days after thrombectomy in this 75 year old woman. Because of continuing symptoms it was decided to infuse streptokinase after a delay of 30 days. Six hours after the immediately pre-infusion venogram (a) a channel had been produced (b) and almost complete clearance was shown on the 6 day venogram.



a b c

Legend to FIG. 69

Streptokinase in post-thrombectomy rethrombosis

Case 4 (Appendix VI)

A 73 year old woman underwent venous thrombectomy 3 days after developing an extensive iliofemoral thrombosis. Operative clearance was incomplete (a) and extensive rethrombosis occurred over the next 6 days (b). Lysis following streptokinase was marked, opening the ascending lumbar collateral (c) and (d). At autopsy 1 day after venogram (d) the iliofemoral segment was completely free of thrombus.


FINAL OP.
PRE-ST.
POST-ST. 1 DAY
2 ½ DAYS
POST-STREPTOKIN
1 DAY
a
b
c
d

Legend to FIG. 70

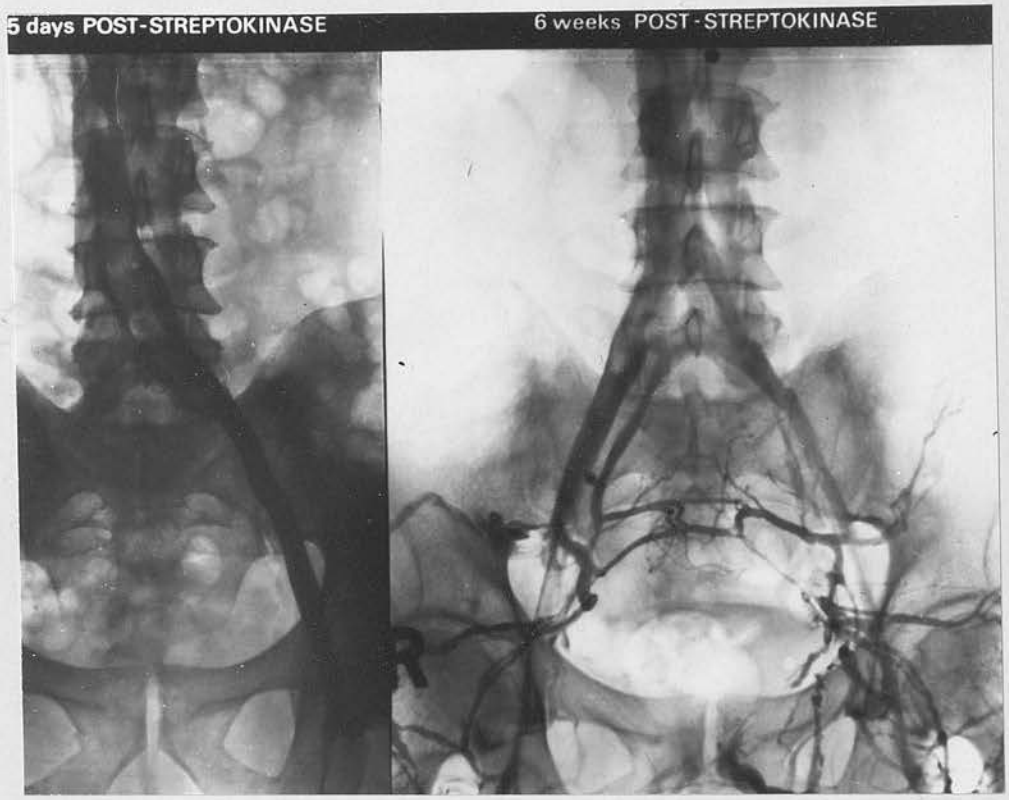
Streptokinase in post-thrombectomy rethrombosis

Case 5 (Appendix VI)

A 48 year old man underwent thrombectomy for an extensive left iliofemoral venous thrombosis complicated by pulmonary embolism. Clearance was incomplete with minimal residual common iliac thrombus and this was maintained over the first 10 post-operative days (a). Four days later thrombosis had extended to involve the I.V.C. (b). After streptokinase the iliac thrombus lysed but the caval thrombus persisted (c). Follow-up venography 6 weeks later showed that not only had patency been maintained but the caval thrombus was no longer present (d).


0 days POST-THROMBECTOMY
PRE - STREPTOKINASE

a b

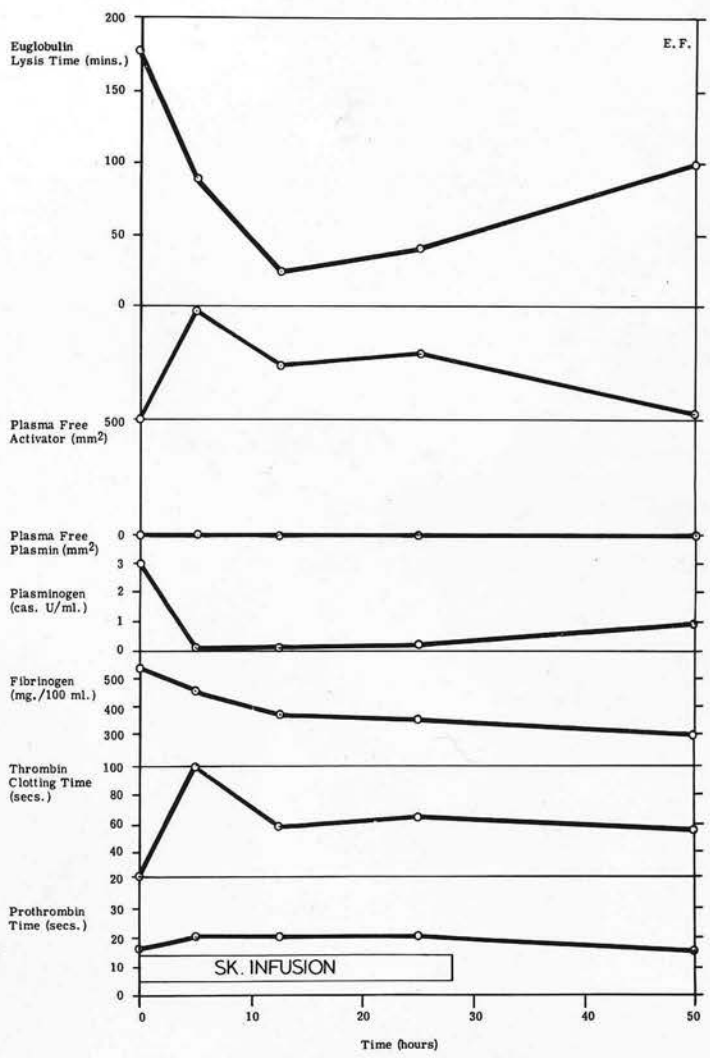

5 days POST-STREPTOKINASE
6 weeks POST - STREPTOKINASE

c d

Legend to FIG. 71

Streptokinase in post-thrombectomy rethrombosis

Graphic representation of haematological results in Case 3 (Appendix VI). Similar results were obtained in all cases.


E. F.
Euglobulin Lysis Time (mins.)
200
150
100
50
0
Plasma Free Activator (mm²)
500
0
Plasma Free Plasmin (mm²)
0
Plasminogen (cas. U/ml.)
3
2
1
0
Fibrinogen (mg./100 ml.)
500
400
300
Thrombin Clotting Time (secs.)
100
80
60
40
20
Prothrombin Time (secs.)
30
20
10
0
SK. INFUSION
0
10
20
30
40
50
Time (hours)

Legend to FIG. 72

Streptokinase in iliofemoral thrombosis

Case 1 (Appendix VII)

This 64 year old lady who suffered extensive pulmonary embolism following an osteotomy of the femur, had a non-occlusive right ilio-femoral thrombosis (a). Streptokinase was infused through a sapheno-femoral catheter and complete lysis was obtained.

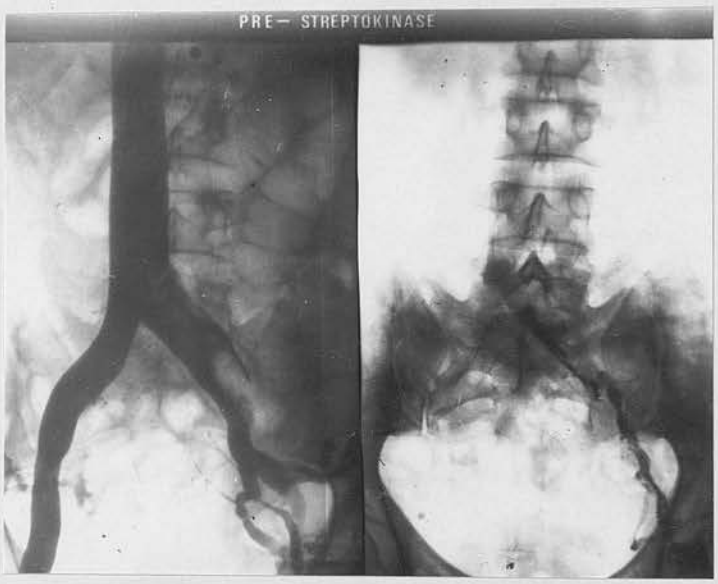
a b

Legend to FIG. 73

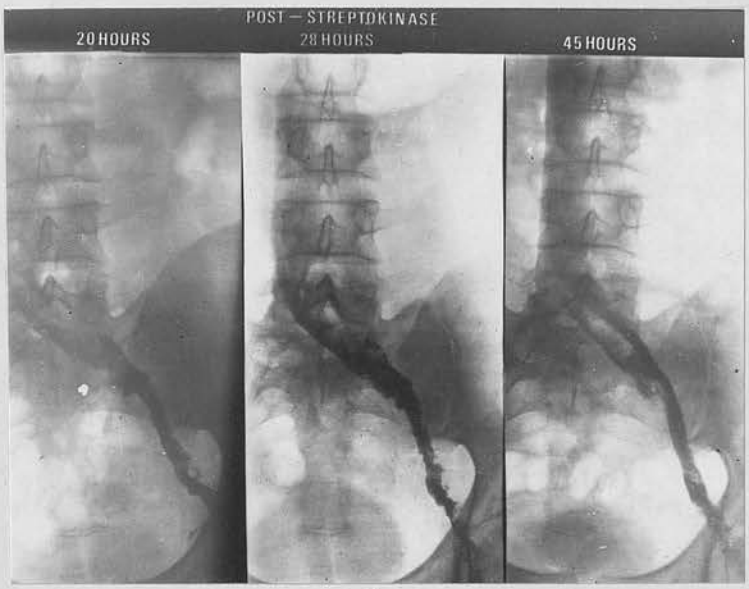
Streptokinase in iliofemoral venous thrombosis

Case 4 (Appendix VII)

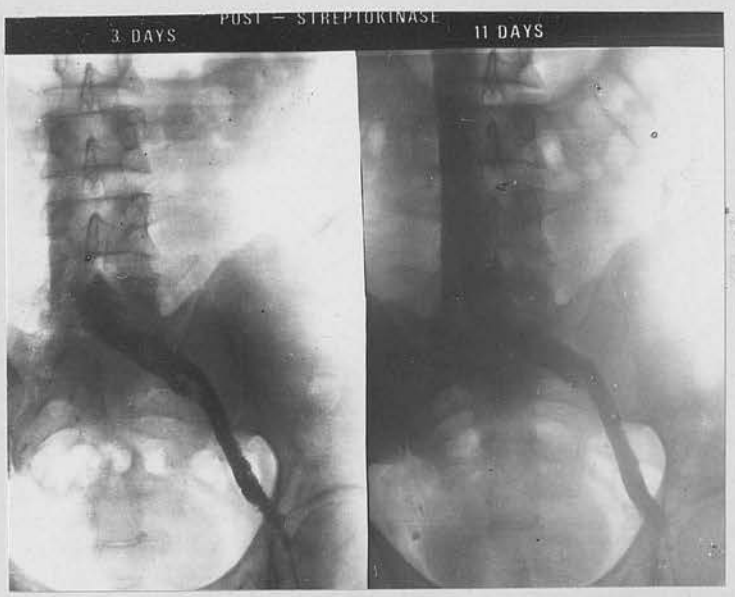
A 50 year old man developed a left iliofemoral venous thrombectomy following a minor calf injury. He did not present until 6 days after occlusion had occurred and venography the following day showed occlusion of the external iliac vein with extension into the common iliac (a). A sapheno-femoral catheter was inserted and before treatment was commenced venogram (b) was taken. Venograms (c) to (g) show progress of thrombolysis over the next 11 days. Definite evidence of external iliac vein rethrombosis has occurred between (c) and (d) but further lysis has occurred by (e). (For full explanation see Appendix VII.)


PRE – STREPTOKINASE

a b


POST – STREPTOKINASE
20 HOURS
28 HOURS
45 HOURS

c d e


POST – STREPTOKINASE
3 DAYS
11 DAYS

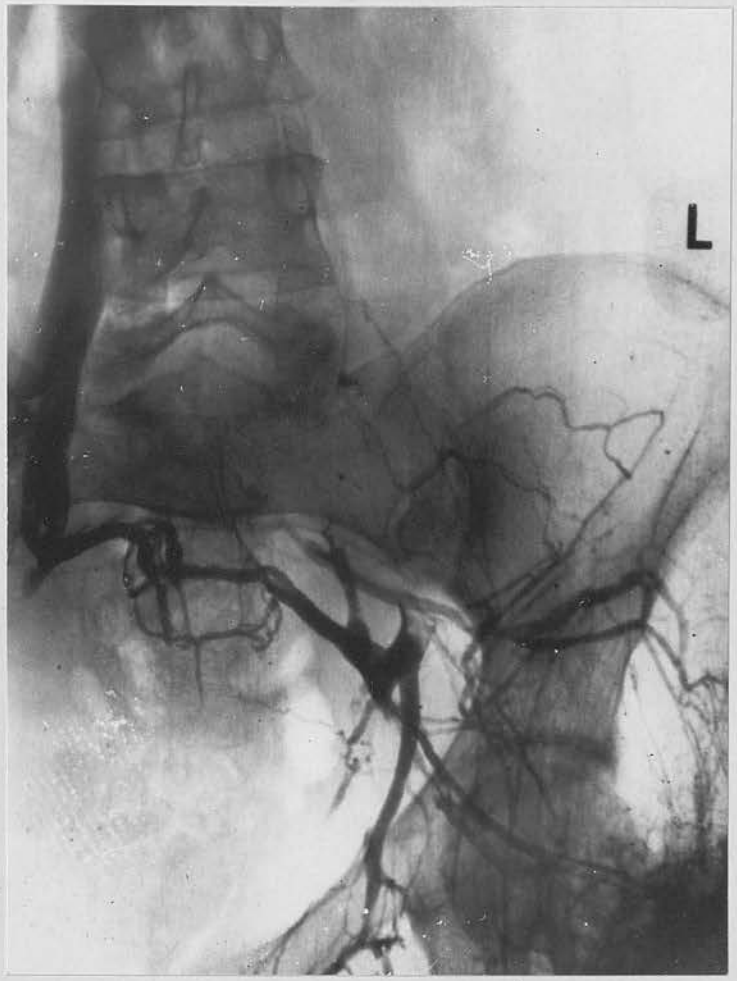
f g

Legend to FIG. 74

Pertrochanteric venography

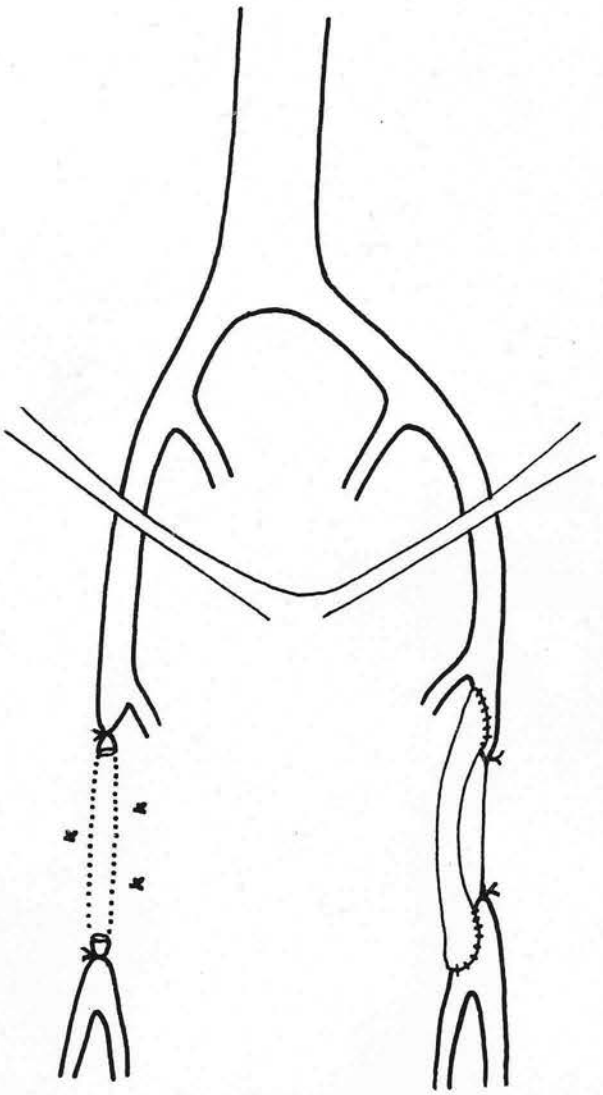
A 42 year old woman developed a painful left leg 6 weeks after sub-trochanteric osteotomy of right femur for osteoarthritis in a congenitally dislocated hip. There was doubt about any increase in size of the left leg and comparison with the wasted right leg was not possible.

Pertrochanteric venography shows complete iliofemoral occlusion. Drainage is by cross-channels to the right iliofemoral segment. Following thrombectomy the size of the left leg decreased dramatically.


L

Legend to FIG. 75

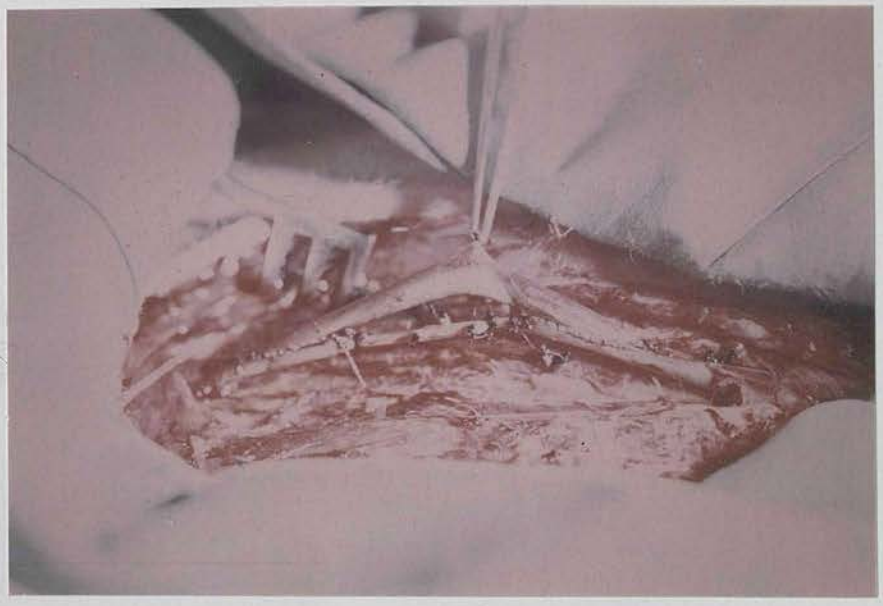
Experimental veno-venous bypass graft. Diagrammatic.



Legend to FIG. 76

Experimental veno-venous bypass graft

Graft exposed prior to removal. This graft was inserted 8 months previously.



Legend to FIG. 77

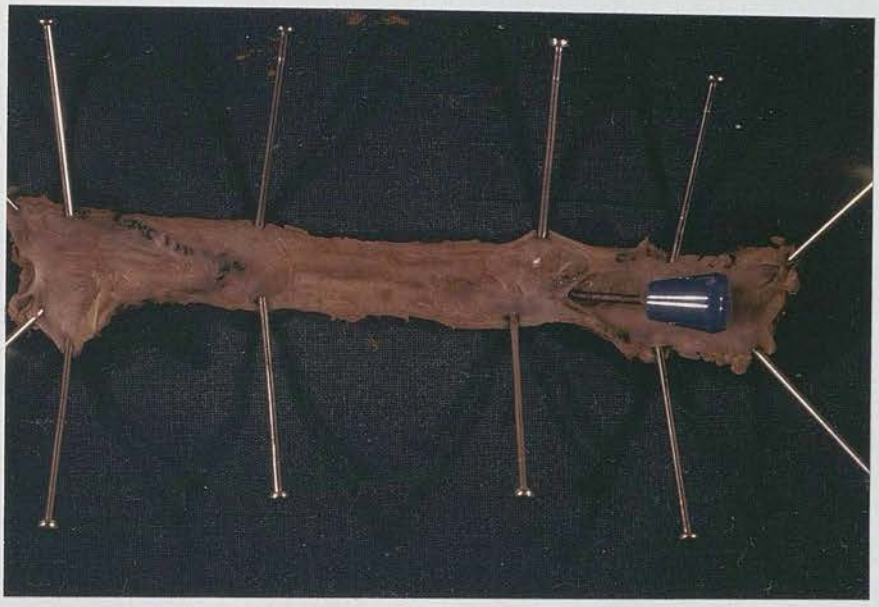
Veno-venous bypass graft - experimental

This venogram was taken 8 months after insertion of the graft. The widely patent bypass graft is indicated by arrows.

Legend to FIG. 78

Experimental veno-venous bypass graft

The graft has been opened longitudinally. The probe is in the remains of the recipient vein.



Legend to FIG. 79

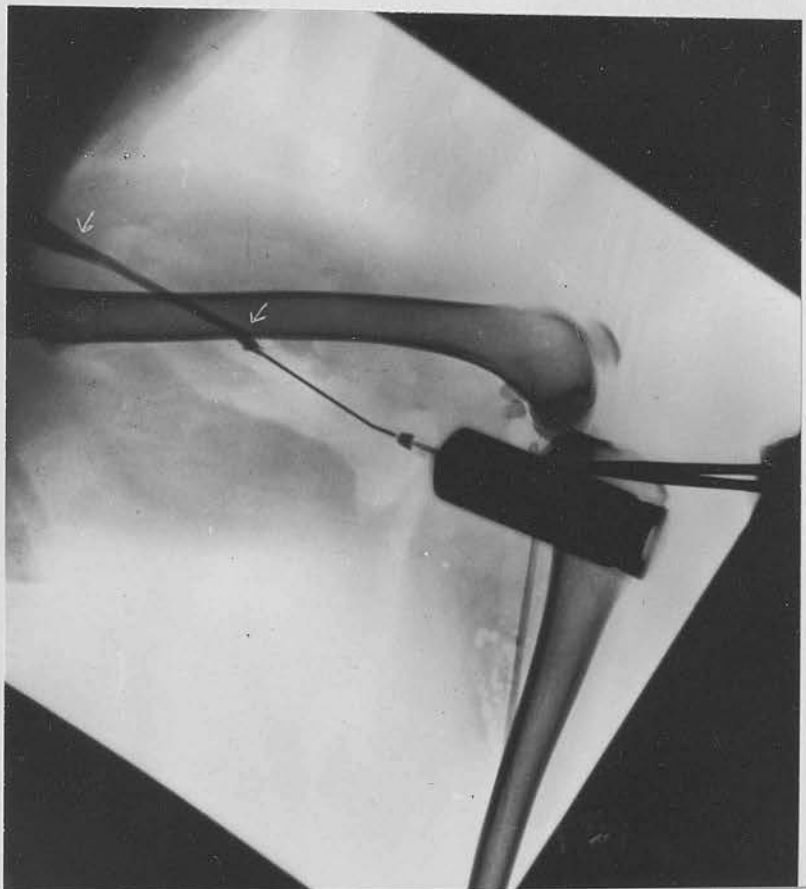
Veno-venous bypass graft - experimental

(a) Venogram through a peripheral vein 8 weeks after grafting. The graft does not fill and was interpreted as being thrombosed.

(b) Venogram on same dog 15 minutes later, after the graft was found to be patent on exposure prior to removal. Injection on this occasion was into the vein just distal to the graft, which is indicated by arrows.

a

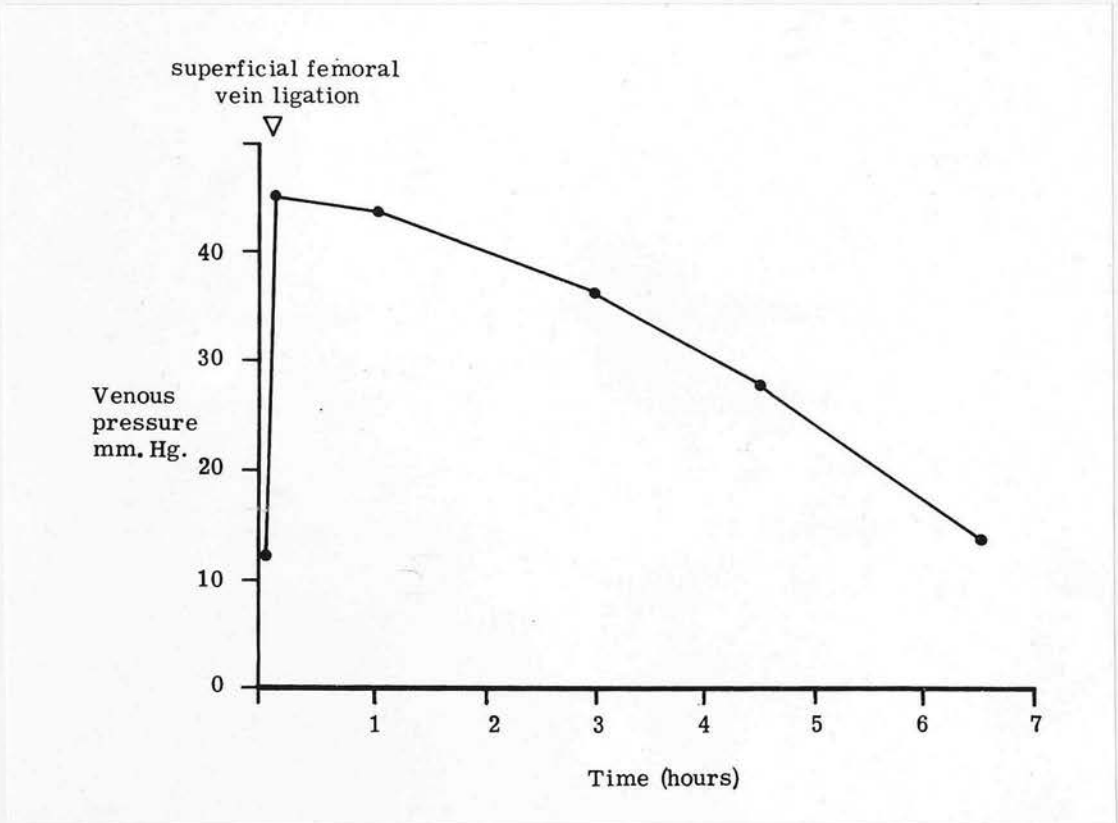
b



Legend to FIG. 80

Effects of superficial femoral vein ligation on venous pressure

Average of 4 experiments. A cannula was placed in the lower superficial femoral vein and the vein ligated proximal to it. Pressures recorded with Statham electromanometer on Devices direct writing recorder.

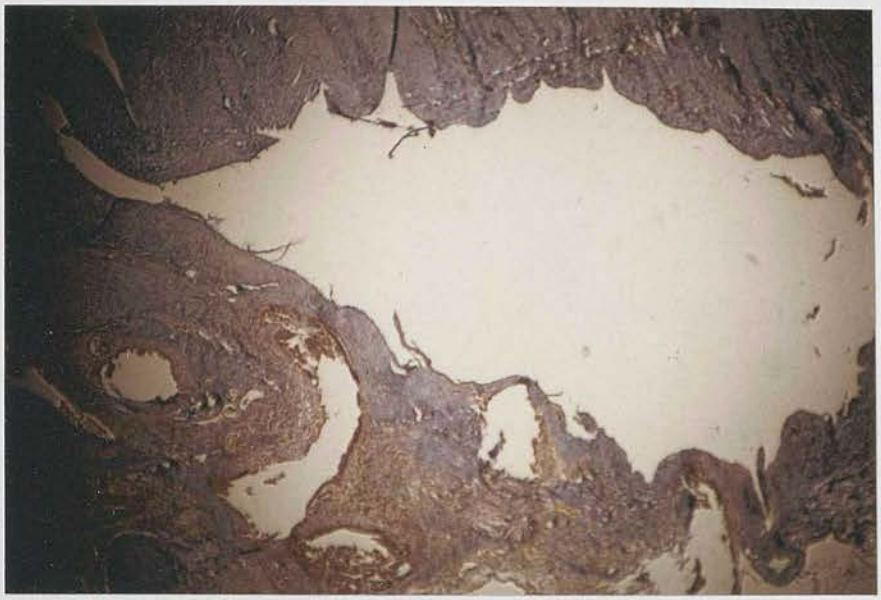

superficial femoral
vein ligation
Venous
pressure
mm. Hg.
40
30
20
10
0
1
2
3
4
5
6
7
Time (hours)

Legend to FIG. 81

Section of Experimental Veno-Venous Bypass Graft

Staining with Martius-Scarlet-Blue.

Original magnification x40.

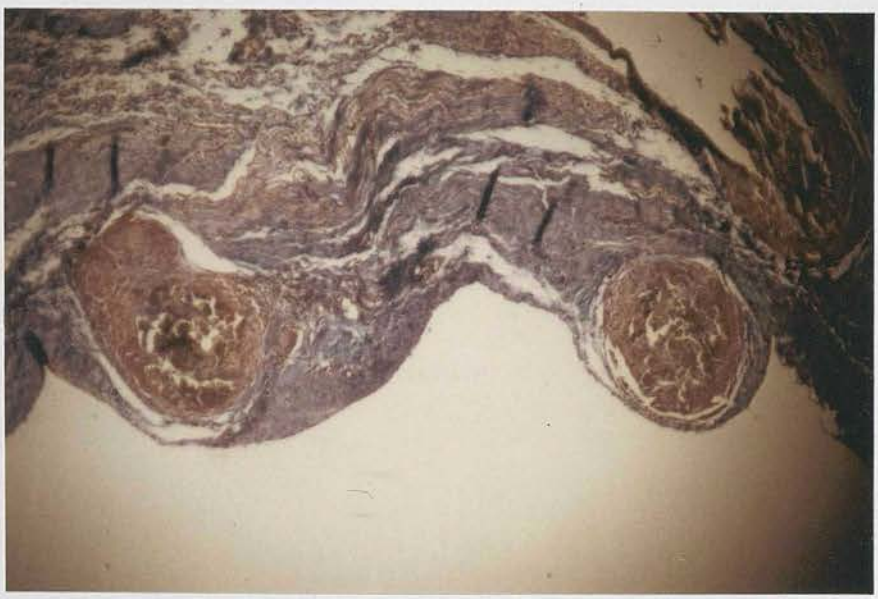


Legend to FIG. 81

Section of Experimental Veno-Venous Bypass Graft

Staining with Martius-Scarlet-Blue.

Original magnification x40.



APPENDIX Ia

Thrombectomy in Iliofemoral Venous Thrombosis

No embolism

No Operative Venography

60 Cases

KEY TO APPENDIX I

Aetiology:
I = Idiopathic
O = Obstetric
M = Medical
S = Surgical
A = Antepartum
P = Post-partum

Clinical Onset:
H = High or Iliofemoral onset
L = Low or Peripheral onset

Embolism Present:
Embolism was the presenting symptom

Anticoagulants (ACs):
Duration of pre-operative therapy in days

Delay:
Delay from onset of disease to operation in days.

Operative origin:
Site of inception of venous thrombosis as determined at operation.

Operative Clearance:

Appendix Ia and Ib
Clearance determined on bleed-back at thrombectomy.
A = Complete clearance
B = Partial clearance
C = Failure to achieve significant clearance

Appendix Ic and Id
Clearance determined on operative venography.
A = Complete clearance
B = Partial clearance

Post-operative rethrombosis:
Determined on early post-operative venography.
N/A = Not applicable, i.e. no venography
- = No rethrombosis
P = Partial rethrombosis
C = Complete rethrombosis

Systemic Upset:
G = Good response, i.e. systemic disturbance settled
P = Poor response

Leg Response:
G = Good response
P = Poor response

Follow-up:

Time:
Duration from operation to follow-up in years

Clinical State:
N = Normal legs
M = Minimal complaints
V = Venous insufficiency

				CLINICAL									OPERATIVE			POSTOPERATIVE PERIOD						FOLLOW-UP		
Case No.	Sex	Age	Aet.	Rt.	Lt.	Onset	Embol. Present	Silent Leg	Late Leg	Phlegm. Caer. Dol.	AC's.	Delay	Origin	Propn.	Clear-ance	Rethr.	EMBOL. Non-Fatal	EMBOL. Fatal	System upset	Leg Resp.	Fibrino-lytic	Period	Clinic.	Venog.
1	F	35	O-A	-	+	L	N/A	N/A	N/A	+	6	9	H	+	A	N/A	-	-	G	G	N/A	1	N	A
2	F	28	O-A	+	-	H	N/A	N/A	N/A	-	7	7	H	-	A	N/A	-	-	G	G	N/A	4	M	A
3	F	40	S	-	+	H	N/A	N/A	N/A	+	9	10	H	+	A	N/A	-	-	G	G	N/A	1	V	C
4	M	44	S	-	+	L	N/A	N/A	N/A	+	0	1	H	+	A	N/A	-	-	G	G	N/A	2	M	-
5	M	80	I	-	+	H	N/A	N/A	N/A	-	0	14	L	+	A	N/A	-	-	G	G	N/A	6	N	-
6	F	24	S	-	+	H	N/A	N/A	N/A	-	0	5	H	+	A	N/A	-	-	G	G	N/A	7	N	-
7	F	38	S	+	-	H	N/A	N/A	N/A	+	6	12	H	-	A	N/A	-	-	G	G	N/A	1	M	B
8	F	28	O-A	-	+	H	N/A	N/A	N/A	-	2	7	H	+	A	N/A	-	-	G	G	N/A	4	M	-
9	F	25	S	-	+	H	N/A	N/A	N/A	+	4	5	H	+	A	N/A	-	-	G	G	N/A	10	N	B
10	F	30	O-P	+	-	H	N/A	N/A	N/A	-	9	11	L	+	A	N/A	-	-	G	G	N/A	3	N	-
11	M	54	S	+	+	H	N/A	N/A	N/A	+	4	5	H	+	A	N/A	-	-	G	G	N/A	1	N	-
12	M	64	I	-	+	L	N/A	N/A	N/A	+	0	7	H	+	A	N/A	-	-	G	G	N/A	-	-	-
13	F	37	S	-	+	H	N/A	N/A	N/A	+	0	1	H	+	A	N/A	-	-	G	G	N/A	3	N	C
14	F	26	O-A	-	+	H	N/A	N/A	N/A	+	1	3	H	+	B	N/A	-	-	G	G	N/A	-	-	-
15	F	34	M	+	-	L	N/A	N/A	N/A	-	0	2	L	+	B	N/A	-	-	G	G	N/A	10	N	-
16	F	20	S	-	+	H	N/A	N/A	N/A	+	5	5	H	-	B	N/A	-	-	G	G	N/A	-	-	-
17	M	41	S	-	+	H	N/A	N/A	N/A	+	1	2	L	+	B	N/A	-	-	G	G	N/A	3	V	-
18	F	30	O-P	-	+	H	N/A	N/A	N/A	+	0	1	H	+	B	N/A	-	-	G	G	N/A	8	M	-
19	F	32	O-P	+	+	H	N/A	N/A	N/A	+	0	3	H	+	B	N/A	-	-	G	G	N/A	12	N	B
20	M	67	M	-	+	H	N/A	N/A	N/A	-	0	6	L	+	B	N/A	-	-	G	G	N/A	-	-	-
21	F	34	O-P	-	+	H	N/A	N/A	N/A	-	2	2	H	+	B	N/A	-	-	G	G	N/A	2	M	-
22	M	50	M	-	+	L	N/A	N/A	N/A	+	0	17	L	+	B	N/A	-	-	G	G	N/A	9	V	B
23	F	34	O-P	-	+	H	N/A	N/A	N/A	+	10	13	H	+	B	N/A	-	-	G	G	N/A	15	M	-
24	F	32	O-P	-	+	H	N/A	N/A	N/A	-	9	9	H	+	B	N/A	-	-	G	G	N/A	5	N	-
25	M	63	M	+	-	L	N/A	N/A	N/A	+	5	5	H	+	B	N/A	-	-	G	G	N/A	-	-	-
26	F	17	O-A	-	+	H	N/A	N/A	N/A	+	0	3	H	-	B	N/A	-	-	G	G	N/A	2	N	A
27	F	21	O-P	-	+	L	N/A	N/A	N/A	+	0	21	L	+	B	N/A	-	-	P	G	N/A	17	N	-
28	F	67	S	+	-	L	N/A	N/A	N/A	-	0	2	L	+	B	N/A	-	-	G	G	N/A	2	M	-
29	F	34	O-A	-	+	H	N/A	N/A	N/A	+	0	6	H	+	B	N/A	-	-	G	G	N/A	4	M	-
30	F	24	O-P	-	+	L	N/A	N/A	N/A	+	0	3	H/L	+	B	N/A	-	-	G	G	N/A	2.5	M	-

Case No.	Sex	Age	Aet.	CLINICAL: Rt.	Lt.	Onset	Embol. Present	Silent Leg	Late Leg	Phlegm. Caer. Dol.	AC's.	Delay	OPERATIVE: Origin	Propn.	Clear-ance	POSTOPERATIVE PERIOD: Rethr.	EMBOL. Non-Fatal	EMBOL. Fatal	System upset	Leg Resp.	Fibrino-lytic	FOLLOW-UP: Period	Clinic.	Venog.
31	F	68	M	+	-	L	N/A	N/A	N/A	-	4	5	L	+	B	N/A	-	-	G	G	N/A	-	-	-
32	F	50	S	-	+	H	N/A	N/A	N/A	-	3	4	H	+	B	N/A	-	-	G	G	N/A	2	M	-
33	F	57	I	+	+	H	N/A	N/A	N/A	+	0	28	H	+	B	N/A	-	-	G	G	N/A	-	-	-
34	F	33	O-P	-	+	H	N/A	N/A	N/A	+	14	14	H	+	B	N/A	-	-	G	G	N/A	-	-	-
35	F	22	O-A	-	+	H	N/A	N/A	N/A	+	0	38	H	+	B	N/A	-	-	G	G	N/A	2	M	C
36	M	28	I	-	+	H	N/A	N/A	N/A	+	0	8	H	-	B	N/A	-	-	G	G	N/A	1	M	B
37	F	31	M	-	+	H	N/A	N/A	N/A	-	0	3	H	-	B	N/A	-	-	G	G	N/A	-	-	-
38	F	58	M	-	+	L	N/A	N/A	N/A	-	6	7	L	+	B	N/A	-	-	G	P	N/A	-	-	-
39	F	31	O-P	-	+	H	N/A	N/A	N/A	+	9	13	H	+	B	N/A	-	-	G	G	N/A	-	-	-
40	F	34	O-A	-	+	H	N/A	N/A	N/A	+	5	5	H	+	B	N/A	-	-	G	G	N/A	3	N	A
41	F	72	S	+	-	L	N/A	N/A	N/A	-	0	12	L	+	B	N/A	-	-	G	G	N/A	3	N	-
42	M	60	S	-	+	H	N/A	N/A	N/A	+	3	3	H/L	+	B	N/A	-	-	G	G	N/A	1	M	C
43	F	36	O-P	-	+	H	N/A	N/A	N/A	+	5	6	H	+	C	N/A	-	-	G	G	N/A	-	-	-
44	F	45	S	-	+	H	N/A	N/A	N/A	+	6	10	H	+	C	N/A	-	-	G	G	N/A	1	M	B
45	F	28	O-P	-	+	H	N/A	N/A	N/A	+	0	3	H	+	C	N/A	-	-	G	G	N/A	2	M	-
46	F	31	O-A	-	+	H	N/A	N/A	N/A	-	0	20	H/L	+	C	N/A	-	-	G	G	N/A	4	N	-
47	M	32	S	-	+	H	N/A	N/A	N/A	+	0	8	H	+	C	N/A	+	-	P	G	N/A	-	-	-
48	F	45	S	-	+	L	N/A	N/A	N/A	-	9	10	L	+	C	N/A	-	-	G	P	N/A	-	-	-
49	F	48	S	-	+	H	N/A	N/A	N/A	+	0	26	H	+	C	N/A	-	-	G	G	N/A	4	M	C
50	M	68	I	-	+	H	N/A	N/A	N/A	-	0	16	L	+	C	N/A	+	-	P	G	N/A	6	V	-
51	M	40	I	+	-	L	N/A	N/A	N/A	+	0	60	L	+	C	N/A	+	-	P	G	N/A	-	-	-
52	F	33	O-P	-	+	L	N/A	N/A	N/A	+	16	20	L	+	C	N/A	-	-	G	G	N/A	13	M	-
53	F	36	O-A	-	+	H	N/A	N/A	N/A	+	0	1	H	-	C	N/A	-	-	G	G	N/A	10	N	-
54	F	53	M	+	+	H	N/A	N/A	N/A	+	0	16	H	+	C	N/A	+	-	P	G	N/A	6	M	-
55	M	28	M	+	-	H	N/A	N/A	N/A	+	0	3	H	+	C	N/A	-	-	G	G	N/A	-	-	-
56	F	46	S	-	+	H	N/A	N/A	N/A	-	0	8	H	+	C	N/A	-	-	G	G	N/A	10	M	-
57	F	66	S	-	+	H	N/A	N/A	N/A	-	3	10	H	+	C	N/A	-	-	G	G	N/A	-	-	-
58	F	33	O-P	-	+	L	N/A	N/A	N/A	-	5	6	H	+	C	N/A	-	-	G	G	N/A	14	M	-
59	F	37	O-P	-	+	H	N/A	N/A	N/A	+	7	7	H	+	C	N/A	-	-	G	G	N/A	1	M	-
60	F	58	I	+	-	H	N/A	N/A	N/A	+	8	18	H	+	C	N/A	-	-	G	G	N/A	-	-	-

APPENDIX Ib

Thrombectomy in Iliofemoral Venous Thrombosis with embolism

No Operative Venography

85 Cases

				CLINICAL									OPERATIVE			POSTOPERATIVE PERIOD						FOLLOW-UP		
Case No.	Sex	Age	Aet.	Rt.	Lt.	Onset	Embol. Present	Silent Leg	Late Leg	Phlegm. Caer. Dol.	AC's.	Delay	Origin	Propn.	Clear-ance	Rethr.	Non-Fatal	Fatal	System upset	Leg Resp.	Fibrino-lytic	Period	Clinic.	Venog.
1	F	68	I	–	+	H	+	–	+	+	4	40	H	+	A	N/A	–	–	G	G	N/A	7	N	–
2	M	30	S	+	+	L	+	–	+	–	0	7	H	+	A	N/A	–	–	G	G	N/A	1	N	A
3	M	39	I	–	+	H	+	–	+	+	0	35	H	–	A	N/A	–	–	G	G	N/A	1	N	–
4	M	56	S	+	–	H	+	–	–	+	3	3	H	+	A	N/A	–	–	G	G	N/A	2	N	–
5	F	46	S	+	–	0	+	+	–	–	20	23	H	–	A	N/A	–	–	G	G	N/A	5	M	A
6	F	52	S	+	–	0	+	+	–	–	0	29	H	–	A	N/A	–	–	G	G	N/A	9	N	A
7	F	39	S	–	+	H	–	–	–	+	6	7	H	+	A	N/A	–	–	G	G	N/A	1	M	C
8	F	54	M	–	+	H	+	–	–	–	17	69	H	–	A	N/A	–	–	G	G	N/A	1	M	–
*9	F	26	O–A	–	+	H	+	–	+	+	14	44	H	–	A	N/A	–	–	G	G	N/A	9	M	B
10	F	63	M	–	+	H	+	–	–	–	23	25	H	+	A	N/A	–	–	G	G	N/A	1	N	A
11	M	54	M	+	–	0	+	+	–	–	20	21	H	–	A	N/A	–	–	G	G	N/A	3	N	–
12	F	37	O–P	+	–	H	+	–	–	+	14	22	H/L	+	A	N/A	–	–	G	G	N/A	12	N	–
13	F	38	S	–	+	H	+	–	–	–	4	7	H	+	A	N/A	+	–	P	G	N/A	3	M	–
14	F	67	S	–	+	0	+	+	–	–	?	?	H	–	A	N/A	–	–	G	G	N/A	6	N	A
15	M	65	I	+	–	0	+	+	–	–	17	60	H	–	A	N/A	–	–	G	G	N/A	3	N	–
16	F	32	O–P	–	+	H	–	–	–	+	7	10	H	+	A	N/A	–	–	G	G	N/A	–	–	–
17	F	40	S	–	+	0	+	+	–	–	8	13	H	–	A	N/A	–	–	G	G	N/A	10	V	–
18	F	79	I	+	–	H	+	–	+	+	10	53	H	+	B	N/A	–	–	G	G	N/A	1	N	–
*19	F	34	O–P	–	+	H	+	–	–	–	11	15	H	+	B	N/A	+	–	P	G	N/A	7	V	–
20	F	36	S	–	+	H	–	–	–	+	30	31	H	+	B	N/A	–	–	G	G	N/A	–	–	–
21	M	36	M	–	+	L	+	–	–	+	5	37	H/L	+	B	N/A	–	–	G	G	N/A	8	N	–
22	F	59	I	+	–	L	+	–	–	–	26	47	H/L	+	B	N/A	–	–	G	G	N/A	7	N	–
23	M	67	I	–	+	H	+	–	+	+	32	60	H	+	B	N/A	+	+	P	G	N/A	----------		
*24	F	62	I	–	+	H	+	–	+	–	32	44	H	+	B	N/A	–	–	G	G	N/A	10	M	–
25	M	60	I	–	+	L	–	–	–	–	42	105	H/L	+	B	N/A	–	–	G	G	N/A	–	–	–
*26	F	26	O–A	+	+	L	+	–	–	+	0	52	H/L	+	B	N/A	–	–	G	G	N/A	8	V	–
27	F	54	S	–	+	H	–	–	–	+	6	7	H	+	B	N/A	–	–	G	G	N/A	4	M	C
28	F	47	S	+	–	L	–	–	–	–	2	4	H/L	+	B	N/A	–	–	G	G	N/A	–	–	–
29	F	69	M	–	+	L	+	–	–	+	2	3	H	+	B	N/A	–	–	G	G	N/A	3	N	–
30	F	34	S	–	+	H	+	–	–	–	3	4	H	–	B	N/A	+	–	P	G	N/A	6	M	–

				CLINICAL									OPERATIVE			POSTOPERATIVE PERIOD						FOLLOW-UP		
																	EMBOL.								
Case No.	Sex	Age	Aet.	Rt.	Lt.	Onset	Embol. Present	Silent leg	Late leg	Phlegm. Caer. Dol.	AC's.	Delay	Origin	Propn.	Clear-ance	Rethr.	Non-Fatal	Fatal	System upset	Leg Resp.	Fibrino-lytic	Period	Clinic.	Venog.
31	M	49	S	-	+	L	+	-	-	-	1	3	H	+	B	N/A	-	-	G	G	N/A	8	M	C
32	F	45	S	-	+	H	+	-	-	+	5	7	H	+	B	N/A	-	-	G	G	N/A	7	M	-
33	F	60	S	+	-	H	+	-	+	-	12	17	H	-	B	N/A	-	-	G	G	N/A	2	N	-
34	M	67	I	+	+	H	+	-	-	-	32	45	H	+	B	N/A	+	-	P	G	N/A	8	N	-
35	F	25	P-0	-	+	L	+	-	+	-	3	3	L	+	B	N/A	-	-	G	G	N/A	6	N	-
36	M	42	S	-	+	H	+	-	+	+	14	14	H	+	B	N/A	-	-	G	G	N/A	5	N	-
37	M	56	I	-	+	H	+	-	-	+	9	13	H	+	B	N/A	-	-	G	G	N/A	3	M	-
38	F	36	S	-	+	L	-	-	-	+	7	7	H/L	+	B	N/A	-	-	G	G	N/A	2	N	A
39	M	59	I	-	+	H	+	-	+	+	47	80	H	+	B	N/A	-	-	G	G	N/A	1	N	-
40	M	56	I	-	+	H	-	-	-	-	15	45	H	+	B	N/A	+	+	P	-	N/A	----------		
41	F	57	S	+	-	H	-	-	-	+	10	11	H	+	B	N/A	-	-	G	G	N/A	9	N	-
42	F	60	S	-	+	H	-	-	-	-	1	1	H	+	B	N/A	-	-	G	G	N/A	4	M	-
*43	M	53	S	+	-	H	-	-	-	-	0	4	H	-	B	N/A	+	-	P	G	N/A	-	-	-
*44	M	29	S	-	+	H	+	-	-	-	15	41	H	+	B	N/A	-	-	G	G	N/A	2	M	-
45	M	75	S	+	-	L	+	-	-	+	0	13	L	+	B	N/A	-	-	G	G	N/A	-	-	-
46	F	40	M	-	+	L	-	-	-	-	4	12	L	+	B	N/A	-	-	G	G	N/A	2	M	-
47	F	58	I	-	+	H	+	-	-	+	12	60	H	+	B	N/A	-	-	G	G	N/A	1	M	-
48	M	57	I	+	-	H	-	-	-	+	22	34	H	+	B	N/A	-	-	G	G	N/A	8	M	-
49	F	74	M	+	-	H	+	-	-	+	14	16	H	+	B	N/A	-	-	G	G	N/A	-	-	-
50	M	64	M	+	-	H	-	-	-	-	10	10	H/L	+	B	N/A	-	-	G	G	N/A	1	N	-
51	F	23	0-A	-	+	H	-	-	-	-	1	13	H	+	B	N/A	-	-	G	G	N/A	5	N	-
*52	M	57	M	-	+	H	+	-	+	+	0	19	H	+	B	N/A	+	+	P	-	N/A	----------		
53	F	52	S	-	+	H	-	-	-	+	0	10	H	+	B	N/A	-	-	G	G	N/A	6	M	-
54	M	25	S	+	+	H	+	-	-	-	12	31	H	+	C	N/A	-	-	G	G	N/A	7	N	-
55	F	38	S	-	+	H	-	-	-	-	12	13	H	+	C	N/A	-	-	G	G	N/A	5	M	-
56	F	27	S	+	-	L	-	-	-	-	5	5	L	+	C	N/A	-	-	G	P	N/A	16	M	-
57	M	47	S	-	+	H	+	-	-	+	3	3	H	+	C	N/A	-	-	G	G	N/A	11	M	B
58	M	37	I	+	+	H	+	-	-	-	W	W	H	+	C	N/A	+	-	P	G	N/A	7	V	-
59	F	31	0-P	+	-	H	-	-	-	+	11	15	H	+	C	N/A	-	-	G	G	N/A	2	V	C
*60	F	63	S	-	+	H	-	-	-	+	35	35	H	+	C	N/A	+	+	P	----------				

				CLINICAL									OPERATIVE			POSTOPERATIVE						FOLLOW-UP		
Case No.	Sex	Age	Aet.	Rt.	Lt.	Onset	Embol. Present	Silent Leg	Late Leg	Phlegm. Caer. Dol.	AC's.	Delay	Origin	Propn.	Clear-ance	Rethr.	EMBOL. Non-Fatal	EMBOL. Fatal	System upset	Leg Resp.	Fibrino-lytic	Period	Clinic.	Venog.
61	F	43	S	+	-	H	+	-	-	+	4	4	H	-	C	N/A	+	+	P	----------				
62	M	73	M	+	+	H	+	-	+	-	21	23	H	+	C	N/A	-	-	G	G	N/A	3	N	-
63	F	37	O-P	-	+	H	-	-	-	+	5	11	H	+	C	N/A	-	-	G	G	N/A	6	M	-
64	M	59	M	+	+	H	+	-	+	+	15	150	H	+	C	N/A	-	-	G	G	N/A	6	N	-
*65	F	52	M	-	+	H	+	-	+	-	36	38	H	+	C	N/A	+	-	P	G	N/A	-	-	-
66	M	54	M	-	+	H	-	-	-	-	13	22	H	+	C	N/A	-	-	G	G	N/A	2	N	-
67	F	47	M	-	+	H	-	-	-	-	0	22	H	-	C	N/A	-	-	G	G	N/A	3	M	-
68	M	51	S	-	+	H	-	-	-	+	31	43	H	+	C	N/A	-	-	G	G	N/A	4	V	-
69	F	67	M	+	-	H	+	-	-	+	1	17	H	+	C	N/A	-	-	G	G	N/A	3	M	-
70	F	65	I	+	-	H	+	-	+	+	0	11	H	+	C	N/A	-	-	G	G	N/A	2	V	-
71	F	58	S	+	-	H	-	-	-	-	4	4	H	+	C	N/A	+	-	P	G	N/A	4	N	-
*o72	F	72	I	+	+	H	-	-	-	+	0	42	H	+	C	N/A	+	+	P	P	N/A	----------		
73	M	62	S	+	+	H	+	-	-	-	12	14	H	+	C	N/A	-	-	G	G	N/A	4	M	-
74	M	52	S	-	+	H	-	-	-	+	8	10	H	+	C	N/A	+	-	P	G	N/A	11	M	-
75	F	53	S	-	+	H	-	-	-	+	10	10	H	+	C	N/A	-	-	G	G	N/A	4	M	-
76	F	55	S	-	+	L	-	-	-	+	11	11	L	+	C	N/A	+	-	P	G	N/A	6	N	-
77	M	66	M	-	+	H	+	-	-	-	9	98	H	+										
78	M	67	M	+	+	H	+	-	-	+	2	21	H	-										
79	F	25	O-A	-	+	H	+	-	-	+	6	6	H	+	B	N/A	-	-	G	G	N/A	5	M	C
80	M	56	I	-	+	L	+	-	+	-	3	10	L	+	B	N/A	-	-	G	G	N/A	2	M	C
81	F	24	O-P	-	+	H	-	-	-	-	14	17	H	+	B	N/A	-	-	G	G	N/A	1	M	-
82	F	70	S	-	+	H	-	-	-	+	23	24	H	+	B	N/A	+	-	P	G	N/A	-	-	-
83	F	63	I	-	+	H	-	-	-	-	20	23	H	+	B	N/A	+	-	P	G	N/A	-	-	-
84	F	27	S	-	+	H	-	-	-	+	4	4	H	+	B	N/A	-	-	G	G	N/A	2	N	A
85	M	48	S	-	+	H	+	-	-	-	13	13	H	+	A	N/A	+	-	G	G	N/A	1	N	A

APPENDIX Ic

Thrombectomy in Iliofemoral Venous Thrombosis

No embolism

Operative Venography

58 Cases

Case No.	Sex	Age	Aet.	CLINICAL									OPERATIVE			POSTOPERATIVE PERIOD						FOLLOW-UP		
				Rt.	Lt.	Onset	Embol. Present	Silent Leg	Late Leg	Phlegm. Caer. Dol.	AC's.	Delay	Origin	Propn.	Clear-ance	Rethr.	EMBOL. Non-Fatal	EMBOL. Fatal	System upset	Leg Resp.	Fibrino-lytic	Period	Clinic.	Venog.
1	F	43	S	+	+	H	N/A	N/A	N/A	+	0	4	H	+	B	N/A	-	-	G	G	-	5	N	-
2	F	27	O-P	-	+	H	N/A	N/A	N/A	+	0	2	H	+	B	N/A	-	-	G	G	-	5	N	-
3	F	67	M	-	+	H	N/A	N/A	N/A	-	0	2	H	+	B	N/A	-	-	G	G	-	3	N	-
4	F	34	O-P	-	+	H	N/A	N/A	N/A	+	0	1	H	+	B	N/A	-	-	G	G	-	-	-	-
5*	M	62	S	-	+	L	N/A	N/A	N/A	+	0	25	L	+	B	N/A	-	-	G	G	-	9	M	-
6	M	64	M	-	+	H	N/A	N/A	N/A	+	0	1	H	+	B	N/A	-	-	G	G	-	-	-	-
7*	F	26	O-P	-	+	H	N/A	N/A	N/A	-	0	1	H	+	B	N/A	-	-	G	G	-	2	M	B
8	M	59	I	-	+	H	N/A	N/A	N/A	+	0	2	H	+	A	N/A	-	-	G	G	-	-	-	-
9	M	62	I	-	+	H	N/A	N/A	N/A	+	0	7	H	-	B	N/A	-	-	G	G	-	7	M	B
10	M	45	M	+	+	H	N/A	N/A	N/A	+	0	10	H	+	B	N/A	-	-	G	G	-	-	-	-
11	F	24	S	-	+	H	N/A	N/A	N/A	-	6	8	H	+	B	N/A	-	-	G	G	-	-	-	-
12	F	34	I	-	+	H	N/A	N/A	N/A	+	0	10	H	+	A[c]	-	-	-	G	G	-	3	N	A
13	F	65	S	-	+	H	N/A	N/A	N/A	+	0	1	H	+	A	-	-	-	G	G	-	2	M	-
14	M	89	S	-	+	H	N/A	N/A	N/A	-	0	1	H	-	A	-	-	-	G	G	-	-	-	-
15	M	54	I	-	+	L	N/A	N/A	N/A	+	0	21	H	+	A[c]	-	-	-	G	G	-	2	M	A
16	F	35	S	+	-	H	N/A	N/A	N/A	+	0	11	H	+	A	-	-	-	G	G	-	5	M	A
17	M	34	S	-	+	H	N/A	N/A	N/A	+	0	1	H	+	A[c]	-	-	-	G	G	-	----------		
18	F	20	O-P	-	+	H	N/A	N/A	N/A	+	0	3	H	+	A[c]	-	-	-	G	G	-	2	N	-
19	F	27	O-P	+	-	H	N/A	N/A	N/A	+	0	4	H	+	A	-	-	-	G	G	-	2	N	A
20	F	26	O-A	+	-	H	N/A	N/A	N/A	+	0	4	H	+	A	-	-	-	G	G	-	-	-	-
21	M	24	S	-	+	H	N/A	N/A	N/A	-	0	1	H	+	A	-	-	-	G	G	-	1	N	A
22	F	69	S	+	-	H	N/A	N/A	N/A	+	10	10	H	+	A	-	-	-	G	G	-	1	N	A
23	F	27	O-P	-	+	H	N/A	N/A	N/A	-	2	2	H	-	A	-	-	-	G	G	-	1	N	-
24	F	47	M	-	+	H	N/A	N/A	N/A	+	0	1	H	+	A	-	-	-	G	G	-	1	N	-
25*	M	60	M	-	+	H	N/A	N/A	N/A	+	0	2	H	-	A	-	-	-	G	G	-	2	M	-
26	M	70	S	-	+	H	N/A	N/A	N/A	+	0	3	H	+	A	-	-	-	G	G	-	-	-	-
27	M	48	S	-	+	H	N/A	N/A	N/A	+	0	1	H/L	+	A	-	-	-	G	G	-	-	-	-
28	M	57	I	-	+	H	N/A	N/A	N/A	-	0	6	H	-	A	-	-	-	G	G	-	-	-	-
29e	F	47	I	-	+	H	N/A	N/A	N/A	+	0	18	H	+	A	P	-	-	G	G	-	-	-	-
30	F	65	S	-	+	H	N/A	N/A	N/A	-	0	8	H/L	+	A	-	-	-	G	G	-	-	-	-

				CLINICAL									OPERATIVE			POSTOPERATIVE PERIOD						FOLLOW-UP		
Case No.	Sex	Age	Aet.	Rt.	Lt.	Onset	Embol. Present	Silent Leg	Late Leg	Phlegm. Caer. Dol.	AC's.	Delay	Origin	Propn.	Clear-ance	Rethr.	EMBOL. Non-Fatal	EMBOL. Fatal	System upset	Leg Resp.	Fibrino-lytic	Period	Clinic.	Venog.
31	F	44	M	–	+	H	N/A	N/A	N/A	–	0	5	H/L	+	A	–	–	–	G	G	–	–	–	–
32	F	73	S	–	+	H	N/A	N/A	N/A	+	0	2	H/L	+	A	–	–	–	G	G	–	1	N	–
33	F	63	S	–	+	H	N/A	N/A	N/A	+	1	1	H	+	A	–	–	–	G	G	–	1	N	–
34	F	66	S	–	+	H	N/A	N/A	N/A	+	0	1	H/L	+	A	–	–	–	G	G	–	1	N	–
35	M	64	S	–	+	H	N/A	N/A	N/A	–	0	3	H	+	A	–	–	–	G	G	–	0.5	N	–
36	F	64	M	+	–	H	N/A	N/A	N/A	+	0	2	H/L	+	A	–	–	–	G	G	–	–	–	–
37	M	72	S	+	–	H	N/A	N/A	N/A	+	0	2	L	+	A	–	–	–	G	G	–	–	–	–
38	F	69	S	–	+	H	N/A	N/A	N/A	+	0	10	H	+	A	–	–	–	G	G	–	0.5	N	A
39	M	69	I	–	+	H	N/A	N/A	N/A	+	0	1	H	–	B	–	–	–	G	G	–	2	M	–
40	F	47	S	–	+	H	N/A	N/A	N/A	+	6	6	H	–	B	–	–	–	G	G	–	6	M	–
41	F	34	S	–	+	L	N/A	N/A	N/A	+	9	12	L	+	B	–	–	–	G	G	–	2	M	–
42	F	42	S	–	+	H	N/A	N/A	N/A	–	2	3	H	+	B	–	–	–	G	G	U	0.75	M	–
43	F	28	0-P	–	+	H	N/A	N/A	N/A	+	0	5	H	+	B	–	–	–	G	G	–	2	N	–
44	F	34	0-A	–	+	H	N/A	N/A	N/A	+	0	9	H	+	B	–	–	–	G	G	–	2	V	C
45	F	19	0-A	–	+	H	N/A	N/A	N/A	+	0	3	H	+	B	C	–	–	G	P	–	1	V	C
46	F	32	0-P	–	+	H	N/A	N/A	N/A	+	0	9	H	–	B	–	–	–	G	G	–	2	M	–
47	F	21	0-A	–	+	H	N/A	N/A	N/A	+	0	4	H	+	B	–	–	–	G	G	–	2	M	–
48	F	25	0-P	–	+	H	N/A	N/A	N/A	+	2	3	H	+	B	–	–	–	G	G	–	1	N	B
49	M	41	S	–	+	H	N/A	N/A	N/A	+	0	2	H	+	B	–	–	–	G	G	–	2	M	–
50	M	49	M	+	+	H	N/A	N/A	N/A	+	0	5	H	+	B	C	–	–	P	G	U	–	–	–
51	M	53	S	+	+	H	N/A	N/A	N/A	+	0	1	H	+	B	–	–	–	G	G	U	1	M	–
52	F	48	S	–	+	H	N/A	N/A	N/A	–	17	18	H/L	+	B	C	–	–	G	P	U	–	–	–
53	F	23	0-P	–	+	H	N/A	N/A	N/A	+	13	14	H/L	+	B	–	–	–	P	G	U	–	–	–
54	F	49	S	–	+	H	N/A	N/A	N/A	+	0	1	H	+	B	–	–	–	G	G	–	1	N	–
55	M	61	S	–	+	H	N/A	N/A	N/A	–	0	1	H	+	B	–	–	–	G	G	–	–	–	–
56	M	19	S	–	+	H	N/A	N/A	N/A	+	0	16	H	+	B	P	–	–	P	G	–	–	–	–
57	F	56	S	–	+	H	N/A	N/A	N/A	+	0	1	H	+	B	P	–	–	G	G	U	8/12	V	C
58	M	20	S	+	–	H	N/A	N/A	N/A	+	0	2	H	+	B	P	–	–	G	G	–	–	–	–

APPENDIX Id

Thrombectomy in Iliofemoral Venous Thrombosis

With embolism

Operative Venography

28 Cases

Case No.	Sex	Age	Aet.	CLINICAL: Rt.	Lt.	Onset	Embol. Present	Silent Leg	Late Leg	Phlegm. Caer. Dol.	AC's	Delay	OPERATIVE: Origin	Propn.	Clearance	POSTOPERATIVE PERIOD: Rethr.	EMBOL Non-Fatal	EMBOL Fatal	System upset	Leg Resp.	Fibrinolytic	FOLLOW-UP: Period	Clinic.	Venog.
1	F	41	S	+	-	H	+	-	-	-	0	1	H	+	A^c	N/A	-	-	G	G	-	4	N	A
2	M	68	S	+	-	0	+	+	-	-	0	2	H	-	A	N/A	-	-	G	G	-	4	N	A
3e	F	54	M	+	-	H	-	-	-	+	2	2	H	+	B	N/A	-	-	G	G	-	-	-	-
4	M	73	I	-	+	H	-	-	-	+	0	35	H	+	B	N/A	-	-	G	G	-	-	-	-
5	F	35	O-P	+	+	H	-	-	-	+	15	38	H	+	B	N/A	-	-	G	G	-	2	N	-
6	F	53	S	-	+	H	+	-	-	-	0	11	H	-	B	N/A	-	-	G	G	-	2	M	-
7*	M	49	M	-	+	H	-	-	+	+	5	14	H	+	B	N/A	+	+	P	G	-	-	-	-
8	F	61	S	+	-	H	-	-	-	+	1	1	H	+	B	N/A	-	-	G	G	-	-	-	-
9	M	58	I	+	-	0	+	+	-	-	0	9	H	-	A^c	-	-	-	G	G	-	3	M	A
10e	M	34	M	+	+	H	+	-	-	+	25	28	H	+	A^c	-	-	-	G	G	-	4	N	A
11*	M	60	S	+	+	H	-	-	-	-	0	1	H	+	A	C	+	-	P	G	-	3	V	C
12	F	27	O-A	-	+	H	+	-	+	+	0	10	H	-	A	-	-	-	G	G	-	2	N	B
13*	F	67	I	+	-	H	-	-	-	-	0	25	H	-	A	-	-	-	G	G	-	1	M	A
14	M	44	S	+	-	0	+	+	-	-	0	14	H	-	A	-	-	-	G	G	-	1	N	A
15*	M	59	I	+	-	0	+	+	-	-	21	24	H	-	A	-	-	-	G	G	-	2	M	B
16	F	45	I	+	-	0	+	+	-	-	4	29	H	-	A	-	-	-	G	G	-	1	N	A
17	M	71	S	-	+	0	+	+	-	-	0	8	H	-	A	-	-	-	G	G	-	1	N	-
18	M	69	I	-	+	H	-	-	-	+	0	20	H	+	A	-	-	-	G	G	-	-	-	-
19	F	33	S	-	+	0	+	+	-	-	0	6	H	-	A	-	-	-	G	G	-	-	-	-
20	F	64	M	-	+	H	-	-	-	-	0	10	H/L	+	A	P	-	-	G	G	-	-	-	-
21	F	25	M	-	+	H	-	-	-	-	0	2	H	+	A	P	-	-	P	G	U	I	N	-
22	M	66	M	-	+	0	+	+	-	-	0	8	H	-	A	-	-	-	G	G	-	I	N	-
23	M	62	M	-	+	H	+	-	+	+	22	24	H/L	+	A	-	-	-	G	G	-	-	-	-
24	F	30	O-A	-	+	H	+	-	+	+	0	5	H	-	B	-	-	-	G	G	-	2	N	B
25	F	24	S	-	+	H	+	-	-	+	2	9	H	+	B	P	-	-	G	G	U	1	M	B
26*	F	45	M	+	-	H	+	-	+	+	0	3	H	+	B	-	-	-	P	G	-	-	-	-
27*	M	43	I	+	-	H	+	-	+	+	0	18	H	+	B	P	-	-	P	G	U	I	M	-
28	F	24	O-P	-	+	H	+	-	+	-	0	2	H	+	B	P	-	-	G	G	U	1.5	M	C

APPENDIX II

BILATERAL SUPERFICIAL FEMORAL VEIN LIGATION FOR PERIPHERAL DVT WITH EMBOLISM

				CLINICAL								OPERATIVE		POST-OP. PERIOD			FOLLOW-UP		
														EMBOL.					
Case No.	Sex	Age	Aet.	Rt.	Lt.	Onset	Embol. Present	Silent Leg	Late Leg	AC's.	Delay	Origin	Propn.	Now Fatal	Fatal	System Upset	Period	Clinic.	Venog.
1	F	31	S	?	?	0	+	+	-	5	8	L	-	-	-	G	7	N	-
2	F	62	S	+	-	L	-	-	-	1	2	L	-	-	-	G	6	N	-
3	M	40	S	?	?	0	-	+	-	0	4	L	-	-	-	G	7	N	-
4	F	41	S	-	+	L	+	-	+	12	13	L	-	-	-	G	5	N	-
5	F	39	S	?	?	0	+	+	-	30	30	L	-	-	-	G	1	N	-
6	F	32	O-P	-	+	0	+	+	-	10	10	L	-	-	-	G	4	N	-
7	M	4	S	-	+	0	+	+	-	2	4	L	-	-	-	G	1	N	-
8	F	28	O-P	+	-	L	-	-	-	12	13	L	-	-	-	G	7	N	-
9	M	74	I	+	-	L	+	-	+	42	42	L	-	-	-	G	-	-	-
10	F	36	O-P	+	-	L	-	-	-	4	15	L	-	-	-	G	-	-	-
11	F	37	S	-	+	L	+	-	-	4	4	L	-	-	-	G	-	-	-
12	F	38	M	-	+	L	-	-	-	6	28	L	-	-	-	G	1	N	A
13	M	58	S	-	+	L	+	-	+	0	5	L	-	-	-	G	1	N	-
14	M	56	M	+	-	L	+	-	+	20	21	L	-	+	-	P	3	N	-
15	F	59	S	-	+	L	+	-	-	5	9	L	-	-	-	G	5	N	A
16	F	27	O-P	?	?	0	+	+	-	5	5	L	-	-	-	G	1	N	A
17	F	64	S	?	?	0	+	+	-	0	5	L	-	-	-	P	6	N	A
18	M	53	I	-	+	L	+	-	+	17	18	L	-	-	-	G	4	N	-
19	F	44	M	+	-	L	-	-	-	0	8	L	-	-	-	G	7	N	-
20	F	38	S	+	-	L	+	+	-	7	30	L	-	-	-	G	1	N	-
21	F	82	I	?	?	0	+	+	-	21	30	L	-	-	-	G	9	N	-
22	F	38	S	-	+	L	-	-	-	12	13	L	-	-	-	G	-	-	-
23	F	62	S	-	+	L	+	-	+	9	16	L	-	+	-	P	-	-	-
24	F	42	S	?	?	0	+	+	-	4	4	L	-	-	-	G	-	-	-
25	F	40	S	-	+	L	-	-	-	19	19	L	-	+	-	P	1	N	A
26	F	55	S	-	+	L	-	-	-	0	6	L	-	-	-	G	1	N	A
27	M	49	S	-	+	L	+	-	-	6	8	L	-	-	-	G	-	-	-
28	F	32	O-P	-	+	L	-	-	-	22	23	L	-	-	-	G	-	-	-
29	F	46	S	-	+	L	+	-	-	22	23	L	-	-	-	G	1	N	A
30	F	39	S	?	?	0	+	+	-	15	15	L	-	-	-	G	3	N	-
31	F	48	S	+	+	L	-	-	-	9	9	L	-	-	-	G	2	N	-

APPENDIX III

SUPERFICIAL PHLEBITIS AND THE ILIOFEMORAL SEGMENT: CASE REPORTS

CASE 1

A 58 year old man with a 40 year history of bilateral varicose veins, was admitted with superficial thrombophlebitis of the left long saphenous vein of six days' duration. This had followed an injury to the thigh. There was a history of one episode of minor pulmonary infarction. On the right side high saphenous ligation had been performed 42 years previously.

On the day of admission the left long saphenous vein was explored and ligated flush with the femoral vein and divided. Before ligation a small plug of thrombus extending into the femoral vein was removed.

Three days later he suffered a pulmonary infarct and this recurred on three occasions over the next three weeks. Bilateral femoral venograms were then taken and showed that the left iliofemoral segment was completely clear, but there was extensive thrombosis without occlusion, of the right common and external iliac veins (Fig. 24). Venous thrombectomy was carried out through the right common iliac vein with arrest of embolism. Follow-up venograms revealed that patency had been maintained.

Comment

At the time of high ligation, the right iliofemoral segment was not visualised. Early detection of the incomplete right iliofemoral occlusion by femoral venography would have reduced the severity and duration of his illness.

CASE 2

A 57 year old man with a 25 year history of bilateral varicose veins and venous ulceration was admitted with a swollen right leg of one week's duration. This was associated with marked thrombophlebitis of the long saphenous vein extending to the groin. He had a history of "pleurisy" with dyspnoea and haemoptysis six weeks previously strongly suggestive of pulmonary infarction.

At operation the same evening the common femoral vein was exposed and found to be occluded by a plug of hard thrombus extending from the mouth of the inflamed long saphenous vein. After removing this clot from the common femoral vein, venography confirmed that there was no thrombus in the iliac veins and the profunda and superficial femoral veins were patent with good blood flow from them. The common femoral venotomy was closed and the long saphenous vein was ligated flush with the femoral. The leg swelling settled dramatically and he made an uneventful recovery.

CASE 3

A 46 year old man had below knee varicose vein surgery carried out and was discharged on his third postoperative day. Thirty-six hours later he suffered a pulmonary embolism. The long saphenous vein above the knee was the seat of thrombophlebitis to mid-thigh level. Bilateral femoral venograms showed clear iliofemoral segments except for a partial filling defect at the level of the sapheno-femoral junction. At operation a plug of thrombus extending from the long saphenous vein into the common femoral vein was removed and the saphenous vein was ligated and divided. He had an uneventful convalescence.

APPENDIX IV

VENOUS GANGRENE: CASE REPORTS

CASE 1

A 67 year old woman suddenly collapsed with breathlessness and right chest pain 16 days following drainage of an appendix abscess. A pleural rub was heard in the right axilla. There were no signs of deep vein thrombosis in the legs or thigh and the patient was commenced on intravenous heparin. Five days later despite adequate anticoagulation, she sustained a further embolus with marked breathlessness and haemoptysis. Four days later anticoagulants were discontinued because of repeated bleeding from her wound.

Two days following the cessation of therapy the patient was found in the early morning in a state of profound shock and the blood pressure could not be recorded. The left leg which had been of normal size the previous evening had become grossly swollen overnight. It was intensely blue and there were signs of incipient gangrene. Infusions of whole blood and plasma restored the blood pressure, and the patient's general condition improved. That evening the superficial veins of the left leg were thrombosed and the right foot became cold and blue. The following morning the leg had early gangrene to the level of the knee. Despite further blood transfusion the patient died later that day.

Autopsy Findings

Both iliofemoral segments were completely occluded by firm pale ante-mortem thrombus extending distally to the popliteal spaces. Superficial veins were also thrombosed on the left and to a lesser extent on the right. All lower limb arteries were patent and healthy. There were bilateral pulmonary infarcts.

CASE 1

A 67 year old woman suddenly collapsed with breathlessness and right chest pain 16 days following drainage of an appendix abscess. A pleural rub was heard in the right axilla. There were no signs of deep vein thrombosis in the legs or thigh and the patient was commenced on intravenous heparin. Five days later despite adequate anticoagulation, she sustained a further embolus with marked breathlessness and haemoptysis. Four days later anticoagulants were discontinued because of repeated bleeding from her wound.

Two days following the cessation of therapy the patient was found in the early morning in a state of profound shock and the blood pressure could not be recorded. The left leg which had been of normal size the previous evening had become grossly swollen overnight. It was intensely blue and there were signs of incipient gangrene. Infusions of whole blood and plasma restored the blood pressure, and the patient's general condition improved. That evening the superficial veins of the left leg were thrombosed and the right foot became cold and blue. The following morning the leg had early gangrene to the level of the knee. Despite further blood transfusion the patient died later that day.

Autopsy Findings

Both iliofemoral segments were completely occluded by firm pale ante-mortem thrombus extending distally to the popliteal spaces. Superficial veins were also thrombosed on the left and to a lesser extent on the right. All lower limb arteries were patent and healthy. There were bilateral pulmonary infarcts.

Comment

This patient who was seen before thrombectomy was established as a form of treatment shows all the classic features of venous gangrene, namely extensive gangrene, pulmonary embolism and hypovolaemic shock from sequestration of blood.

CASE 2

A 72 year old woman was admitted with an extensive left iliofemoral thrombosis complicated by recurrent pulmonary embolism. The left leg was dusky and cyanotic. It was grossly swollen, there being a 7.5 cm. difference in thigh and calf measurements between the two sides. Chest X-ray showed changes consistent with pulmonary infarction.

Left femoral thrombectomy was undertaken and satisfactory clearance, as judged by proximal and distal bleeding was obtained. Postoperatively anticoagulant therapy with Dindevan was commenced. Despite the prothrombin ratio being maintained in the "effective" therapeutic range extensive rethrombosis occurred on the 6th postoperative day and the left leg became grossly swollen and cyanotic and the following day there was evidence of gangrene involving the toes. At this stage a further attempt at thrombectomy was unsuccessful because of firm adherence of the thrombus. Because of the rapidity with which fluid was accumulating in the leg and because there were signs of cardiovascular collapse despite fluid replacement external iliac artery ligation was carried out. This resulted in an improvement in her general condition and a reduction in leg swelling, although the gangrene persisted (Fig. 33). Above-knee amputation was required after 6 weeks of conservative management had failed to produce any improvement.

While the left leg was being treated conservatively and while still on adequate dosage of anticoagulant drugs the right leg suddenly became swollen and blue. Right femoral thrombectomy was attempted but clearance was inadequate and poor bleed back obtained. This foot also slowly became gangrenous despite continuing anticoagulants (Fig. 34).

Following right above knee amputation the patient developed a septicaemia which did not respond to antibiotics and she died.

Autopsy Findings

Massive embolism of the left pulmonary artery was the immediate cause of death. There was extensive venous thrombosis of the femoral, external and common iliac veins on both sides with occlusion of the inferior vena cava (Fig. 35). All arteries were patent both in the amputated and unamputated limb.

Comment

This patient's thrombophlebitis did not respond to anticoagulants or thrombectomy. A better result might have been obtained had venous clearance been better as can be achieved with the Fogarty catheter, operative venography, and caval thrombectomy.

CASE 3

A 42 year old man was admitted with a seven weeks' history of left iliofemoral venous thrombosis. The reason for his admission was a minor pulmonary embolus. The left leg was grossly swollen and cyanosed, and there were gangrenous changes in the tips of the toes. Posterior tibial pulses were palpable on both sides.

Despite a diagnosis of iliofemoral venous thrombosis with venous gangrene, it was decided it was too late for thrombectomy to be successful and he was treated conservatively with elevation, supportive bandaging and exercises. Bilateral femoral arteriography showed normal main vessels. The gangrenous areas were allowed to separate and they did so in about 6 months.

Femoral venograms carried out 1 year after the onset of the episode confirmed the presence of a left sided iliofemoral venous thrombosis with occlusion of the lower part of the inferior vena cava.

CASE 4

A 54 year old woman was admitted with an extensive right iliofemoral venous thrombosis with massive swelling and early gangrenous changes in the second and third toes. This had developed while she was in bed with a left hemiplegia resulting from right internal carotid artery thrombosis 10 days previously. At emergency venous thrombectomy clearance was incomplete but a channel to the inferior vena cava was produced. Within 18 hours of operation the leg returned to its normal size and the discolouration of the toes subsided. Three days later her cerebral condition deteriorated quite suddenly and she died.

Autopsy Findings

The right internal carotid artery was thrombosed and there were large areas of softening in the right cerebral hemisphere. The right pulmonary arteries contained antemortem thrombus, and there were numerous infarcts. There was recent left ventricular myocardial infarction. The right common femoral and external iliac veins contained moderate nonocclusive antemortem thrombus.

Comment

The venous gangrene was controlled by venous thrombectomy but the patient died from her extensive atherosclerosis. Thrombectomy was justifiable as it was not possible to give an accurate prognosis for her arterial disease.

CASE 5

A 43 year old man was admitted to a medical ward with left sided pulmonary infarction, swelling of the left leg and pain and tenseness of the right calf. He was treated with Methicillin and Dindevan.

Four days after admission the pain in both legs increased in severity and the feet became cyanotic, tense and swollen. There were extensive ecchymoses over both legs and tenderness over the femoral and subsartorial canals. The left leg was cold and anaesthetic, and there was marked impairment of power. The toes were gangrenous (Fig. 36) as was the skin over the gastrocnemius and the underlying muscle (Fig. 37).

Combined bilateral femoral and caval thrombectomies were carried out and a good clearance obtained of the extensive thromboses which involved both iliofemoral segments with propagation to the level of the popliteal fossae.

The postoperative period was stormy and he suffered several small pulmonary emboli. The gangrenous areas on the second and third toes slowly separated as did the gangrenous gastrocnemius muscle. The skin over this area healed poorly and had to be grafted on 2 occasions.

He is now working full-time, on his legs all day as a grocer, without signs of venous insufficiency. Bilateral femoral venography 4 years after operation shows healthy, patent iliofemoral segments and inferior vena cava (Fig. 38).

Comment

The aggressive approach from the cava was undertaken because of the extreme circumstances. With maintenance of patent iliofemoral segments he has no venous insufficiency.

CASE 6

A 48 year old man who 3 months previously had had an anterior resection for an obstructing carcinoma of rectosigmoid junction, presented with an acute extensive left iliofemoral venous thrombosis. The leg was extremely painful from the groin down and over the course of 4 hours became cold and blue (Fig. 39). The patient was shocked with blood pressure of 86/50. There was moderate groin tenderness. Sensation was absent over the foot and diminished to below the knee. No pulses were palpable below the femoral on that side, and all pulses had been present at the time of his admission. Two units of whole blood were infused and blood pressure rose to 98 mm. Hg. systolic. Under local anaesthesia thrombectomy was carried out from the left common femoral vein. On making the venotomy thrombus was ejected to a height of $1\frac{1}{2}$ - 2 feet above the wound. Complete clearance was obtained, and this position was maintained throughout the next 12 days while the saphenofemoral catheter was in position. Pain disappeared dramatically by the end of the operation and by the following morning the limb had returned to its normal size (Fig. 40), and sensation and pulses had returned. Blood pressure recovered over the course of the first 2 hours postoperatively and remained stabilised at 120/70 mm.Hg. The patient died 3 months later of metastatic carcinoma without recurrence of venous thrombosis.

APPENDIX V

UROKINASE IN ILIOFEMORAL VENOUS THROMBOSIS

CASE 1

A 24 year old woman was referred with an extensive left iliofemoral venous thrombosis complicated by 2 episodes of pulmonary embolism. At femoral thrombectomy the final operative venogram showed that despite every effort residual thrombus persisted in the common iliac vein (Fig. 50a). Urokinase was commenced at the completion of the operation at 120 units/min. (i.e. the critical activator concentration).

A venogram 30 minutes later showed rethrombosis of a segment of the common iliac vein which had been patent in the final operative film (Fig. 50b). Urokinase was maintained at this dosage for $18\frac{1}{2}$ hours and was then doubled as no lysis had occurred. Within $2\frac{1}{2}$ hours of commencing the increased dose definite thrombolysis was evident, the extent of this increasing over the next 2 hours (Fig. 50c). The Urokinase was discontinued after no further lysis was demonstrated following a further 2 hours' therapy. Heparin saline infusion (10,000 units 8 hourly) was given for the next 3 days.

Venography four months after treatment showed complete external and common iliac occlusion.

Comment

This was the first occasion on which topical Urokinase was employed and too low dosage of Urokinase was maintained over too long a period.

CASE 2

A 42 year old woman with a 3 day old left iliofemoral venous thrombosis underwent thrombectomy at which a good channel was produced but mural thrombus persisted in the common iliac vein. Twice the critical concentration for 11 hours produced no evidence of lysis in venograms up to 4 days later.

CASE 3

A 53 year old man developed an extensive femoral iliac and caval thrombosis following nephrectomy for a hypernephroma which extended into the vena cava. At thrombectomy clearance was incomplete and twice the critical activator concentration of Urokinase for 23½ hours produced no lysis on venography up to 3 days later.

CASE 4

A 23 year old woman underwent thrombectomy for an extensive postpartum iliofemoral venous thrombosis which had been present for 2 weeks. The external iliac vein was cleared but the common iliac vein remained occluded, and an infusion of twice the critical concentration of Urokinase for 14 hours produced no thrombolysis.

CASE 5

A 24 year old woman underwent thrombectomy for an extensive left ilio-femoral venous thrombosis of acute onset and 3 days' duration, occurring 7 days post-partum. The final operative venogram at thrombectomy showed persisting common iliac clot (Fig. 5la).

An infusion of one and a half times the critical concentration of Urokinase was commenced. Venography after half an hour showed evidence of common iliac rethrombosis. Further venography after another 3½ hours demonstrated partial common iliac vein thrombosis with thrombus surrounding the catheter in the external iliac vein but the vena cava was outlined (Fig. 5lb). The catheter was therefore withdrawn to low in the external iliac vein, and Urokinase continued. Further venography after 3½ hours showed the external and common iliac veins and the inferior vena cava outlined well, but with a little residual thrombus in the common iliac vein. Urokinase was discontinued and replaced by Heparin saline 10,000 units 8 hourly. Venography repeated two days later revealed completely clear ilio-femoral and caval segments (Fig. 5lc), and this was maintained until the catheter was removed on the 10th postoperative day.

Follow-up venography 6 weeks after operation showed that rethrombosis of both external and common iliac vein had occurred.

Case 6

A 49 year old man developed an iliofemoral venous thrombosis while under investigation for a hypernephroma. Nephrectomy and venous thrombectomy were carried out at the same time. The tumour was found to extend along the renal vein and involved the inferior vena cava. At thrombectomy thrombus in the vena cava could not be removed, and although iliac clearance was achieved early rethrombosis occurred. Urokinase lysed neither the reformed iliac thrombus nor the residual caval thrombus.

CASE 7

A 56 year old woman developed an extensive left iliofemoral venous thrombosis 7 days after an anterior resection for a carcinoma of the rectum. In the previous 10 years she had had three similar but less severe episodes of leg and thigh swelling which had settled in a few days with bed rest. There was no history of pulmonary embolism.

At femoral thrombectomy it was not possible to clear the terminal part of the common iliac vein, and the vena cava was not visualised. On the 9th postoperative day rethrombosis of the external iliac vein occurred (Fig. 52a). An infusion of twice the critical activator concentration of Urokinase produced lysis of the external iliac thrombus but did not clear the common iliac vein and the vena cava was not outlined (Fig. 52b). Clinical recovery was satisfactory and when discharged 17 days after thrombectomy she had no venous insufficiency.

Follow-up venography 8 months later showed complete occlusion of the iliofemoral segment.

Case 8

A 43 year old man was admitted with an extensive left iliofemoral venous thrombosis associated with recurrent pulmonary embolism. At thrombectomy it was not possible to completely clear the iliofemoral segment, a small quantity of thrombus persisting in the upper part of the external iliac vein. Rethrombosis occurred during the first 3 postoperative days and Urokinase therapy was undertaken. Twice the critical concentration for 8 hours and double this dose for 6 hours produced evidence of some thrombolysis without complete clearance (Fig. 53).

Comment

This patient had a particularly active form of thrombophlebitis associated with high fever and erythrocyte sedimentation rate. Shortly afterwards he developed a right iliofemoral thrombosis and, for many months, had recurrent episodes of superficial thrombophlebitis involving the legs and trunk.

CASE 9

A 25 year old woman developed a left iliofemoral venous thrombosis while under investigation for ulcerative colitis. At thrombectomy complete clearance was obtained (Fig. 54a). Clearance was maintained for 8 days but following the transfusion of whole blood massive rethrombosis occurred with rapid deterioration in the condition of the leg (Figs. 54 b and c). Urokinase infusion of twice the critical concentration for 6 hours produced only partial lysis of the thrombus (Fig. 54d), but considerable clinical improvement. This improvement has been maintained over the past 9 months.

CASE 10

A 48 year old woman developed a left iliofemoral venous thrombosis while in bed recovering from compression fractures of the 1st and 4th lumbar vertebrae. This failed to respond to prolonged anticoagulant therapy. At thrombectomy, although the external iliac vein was cleared, common iliac thrombus persisted, and rethrombosis occurred over the first three postoperative days (Fig. 55a). Two infusions of Urokinase of twice and four times the critical activator concentration produced slight lysis of external and freshly formed common iliac thrombus (Fig. 55b).

Comment

Definite thrombolysis was produced in a completely occluded venous segment, despite the fact that most of the fibrinolytic agent must be diverted into collateral channels.

APPENDIX VI

STREPTOKINASE IN POST-THROMBECTOMY RETHROMBOSIS

KEY TO APPENDIX VI and VII

The cases treated with streptokinase are detailed in Appendices VI and VII. The haematological results in each case are given as a Table at the end of the case report. These are referred to in the case reports simply as (Table).

Case 1

A 79 year old woman with a chronically swollen left leg following post-partum iliofemoral venous thrombosis 57 years previously, was admitted to a medical unit with a neoplasm of stomach. While under investigation she developed a right iliofemoral venous thrombosis with incipient venous gangrene of the foot.

At right femoral thrombectomy a channel was produced in the iliac veins but a non-occlusive plug of thrombus was left at the caval confluence (Fig. 66 - a.). Post-operatively heparin saline (2,000 units/24 hrs.) was infused. Extensive rethrombosis occurred over the next five days (Fig. 66 - b). Streptokinase was infused for 29 hours to a total dose of 2,350,000 units, systemic fibrinolytic activity being produced (Table). Extensive lysis resulted so that the iliacs and cava were free of thrombus. Even the plug present at the completion of thrombectomy disappeared (Fig. 66 - c). Marked improvement occurred in the leg and this was maintained despite the fact that venography 5 days after streptokinase infusion showed that extensive caval thrombus had reformed (Fig. 66 - d). Heparin saline infusion was continued for a further 3 days but warfarin was not given.

On the twelfth day after streptokinase she developed an extensive right femoro-popliteal arterial thrombosis and gangrene rapidly supervened. Her general condition deteriorated and she died 20 days after streptokinase.

Autopsy Findings. The right external, internal and common iliac veins were thrombosed and the thrombus extended into the I.V.C. The right renal vein was occluded by thrombus. There was an embolus in the left lower lobe pulmonary artery. There was a large gastric neoplasm with replacement of most of the liver with secondary tumour.

Comment

Extensive thrombolysis in this case resulted in almost complete clearance. However rethrombosis occurred early, as shown by venography, and was complete at death 20 days after the streptokinase infusion. Warfarin was not given in this case because of the risk of haemorrhage from the gastric neoplasm. Because of the extent of rethrombosis in this case it was decided to use warfarin in future cases.

APPENDIX VI

Case 1

Time	SK Dose	Thrombin Clotting Time (secs)	Fibrinogen level (mg%)	Euglobulin Lysis Time (mins)	Plasminogen (cu/ml)	Plasma Activator	Free Plasmin	Quick Prothrombin Time (secs)	Whole blood lysis time (hrs)	Kaolin Clotting Time
0 hrs	2,350,000 u. streptokinase	18	400	660	3.1	-	-	20	≫24	-
1 hr		22	350	3	0.3	++	++	24		45
5 hrs		38	280	41	0.0	+++	-	23	>24	47
20 hrs		90	160	35	0.0	++++	-	24	>24	55
28 hrs		65	80	20	0.0	+++	±	25	24	45
32 hrs		26	180	60	0.9	±	±	24	>24	60

Case 2

This 63 year old woman developed an extensive left iliofemoral venous thrombosis after being in bed for 2 weeks with a left hemiplegia. Thrombectomy carried out 3 days after occlusion was complete resulted in only partial clearance (Fig. 67 - a) and extensive rethrombosis occurred over the next 10 days until occlusion was complete (Fig. 67 - b).

Streptokinase infusion was not commenced until 12 days after rethrombosis had first started and was continued for 28 hours to a total dose of 3,100,000 units. Systemic fibrinolytic activity resulted (Table). Extensive thrombolysis occurred and a channel was produced opening up the ascending lumbar collateral channel (Fig. 67 - c, d and e). Thrombolysis progressed over the first 4 days after streptokinase was discontinued (c.f. Figs. 67 - d and e).

Following streptokinase heparin saline (15,000 units 8 hourly) was infused for 48 hours and warfarin was commenced and continued over a 6 week period. The improvement produced in the leg was maintained over the next 6 weeks which she remained in hospital. There was only moderate recovery from the hemiplegia. A small wound haematoma developed but this required no treatment, resolving over 10 days.

APPENDIX VI

Case 2

Time	SK Dose	Thrombin Clotting Time (secs)	Fibrinogen Level (mg%)	Euglobulin Lysis Time (mins)	Plasmin-ogen (cu/ml)	Plasma Activator	Free Plasmin	Quick Prothrombin Time (secs)
-20 mins	3,100,000 u. streptokinase	27	460	470	3.95	-	-	17
0 hrs		58	360	70	0.0	+++	-	18
4 hrs		65	340	90	0.0	++	-	21
18 hrs		45	370	50	0.0	+	-	20
25 hrs		40	290	40	0.25	±	-	18
40 hrs		65	300	115	1.2	-	-	20

Case 3

A 75 year old woman was admitted with an extensive left iliofemoral venous thrombosis of 4 weeks duration. There was no history of pulmonary embolism but the woman was extremely ill.

Thrombectomy was attempted through the left common femoral vein but the common iliac vein could not be cleared and venograms over the next 10 days showed progressive rethrombosis of the external iliac vein. In addition she suffered two episodes of pulmonary infarction and a high swinging pyrexia continued. Bilateral femoral venograms at this stage showed that in addition to the left iliofemoral thrombosis the right common iliac vein was occluded. Right femoral thrombectomy resulted in clearance of the common iliac vein but 3 days later there was complete bilateral common iliac and caval thrombosis. Both legs were grossly swollen and oedematous. High fever continued and there was further pulmonary embolism. Large bilateral pleural effusions developed and after the second tapping the right side became infected.

Her general condition became extremely poor and because of continued embolism caval ligation was considered but a trial of streptokinase was undertaken as a first step 30 days after the right side had rethrombosed. A total dose of 2,850,000 units was given over 27 hours via a cannula inserted in the right long saphenous vein. There was evidence of lysis in the right ilio-femoral segment and inferior vena cava on the 6 hour venogram (Fig. 68 - b), and this continued over the next 5 days (Fig. 68 - c), when venograms were discontinued. During this time there was dramatic subjective and objective improvement in her general condition. The right leg swelling disappeared.

However, over the next two days the right empyema increased and despite further drainage and antibiotics she died in respiratory failure.

Autopsy Findings. The left iliofemoral segment was totally occluded by organising thrombus. The right iliofemoral segment and the inferior vena cava were virtually clear of thrombus. There were extensive bilateral pulmonary infarcts and a right empyema.

Comment

No underlying lesion such as a malignant neoplasm was found as a cause for the ultra acute thrombophlebitis in this case.

In the absence of symptoms and signs of pulmonary embolism when this lady was first seen the high pyrexia should have led to a suspicion of embolism and bilateral venography undertaken. Caval thrombectomy to clear both sides may well have been indicated.

Lysis of thrombus known to be 30 days old was produced and the improvement in this patient's general condition during this period was dramatic.

The possibility that streptokinase may have promoted spread of the empyema by breaking down fibrin barriers cannot be excluded but evidence of spread of infection occurred only after systemic fibrinolytic activity was no longer detectable in the blood.

APPENDIX VI

Case 3

Time	SK Dose	Thrombin Clotting Time (secs)	Fibrinogen Level (mg%)	Euglobulin Lysis Time (mins)	Plasminogen (cu/ml)	Plasma Activator	Free Plasmin	Quick Prothrombin Time (secs)
-20 mins	2,850,000 u. streptokinase	27	540	180	3.0	-	-	16
4 hrs		120	460	90	0.0	+++	-	20
10 hrs		57	380	25	0.0	++	-	20
24 hrs		61	360	40	0.1	++	-	20
54 hrs		55	290	100	0.9	±	-	14

Case 4

A 73 year old diabetic woman underwent venous thrombectomy 3 days after developing an extensive left iliofemoral venous thrombosis. The thrombus removed was old and organising and the common iliac vein could not be cleared (Fig. 69 - a). Extensive rethrombosis occurred over the next 6 days (Fig. 69 - b) and because of this streptokinase was administered through the sapheno-femoral catheter, a total of 5,850,000 units being administered over a 52 hour period. Venography showed that marked lysis was produced (Figs. 69 - c and d) until the ascending lumbar vein was opened as a collateral channel. On the third day after commencing streptokinase the patient experienced severe chest tightness with marked dyspnoea. E.C.G. suggested that this was due to myocardial infarction and despite intensive treatment the patient died, later the same day.

Autopsy Findings. The iliofemoral segments were completely free of thrombus. There was no evidence of pulmonary embolism or infarction. There was an extensive anterior myocardial infarction. All the major coronary arteries were grossly stenosed from calcific atheroma but there was no evidence of thrombosis in any of the vessels.

Comment

Lysis was eventually complete in this case, having continued between the time of the final venogram and autopsy. Myocardial infarction developing without further arterial occlusion is not explained.

This patient experienced a severe allergic reaction in the form of fever and joint pains soon after commencing therapy. Hydrocortisone hemisuccinate by the intravenous route produced rapid benefit.

APPENDIX VI

Case 4

Time	SK Dose	Thrombin Clotting Time (secs)	Fibrinogen Level (mg%)	Euglobulin Lysis Time (mins)	Plasminogen (cu/ml)	Plasma Activator	Free Plasmin	Quick Prothrombin Time
-20 mins		20	530	>1000	3.50	-	-	16.5
3 hrs	5,850,000 u. streptokinase	29	430	180	0.10	+++	-	23.0
8 hrs		27	380	190	0.25	++	-	18.0
27 hrs		45	380	150	0.20	++	-	17.0
35 hrs		37	380	40	0.10	+	-	16.5
51 hrs		30	390	60	0.20	++	-	18.0
75 hrs		32	180	35	0.20	+	±	19.0
85 hrs		65	80	-	-	+	±	30.0
100 hrs		30	190	85	1.25	+	±	20.0

Case 5

This 48 year old man had been extensively investigated in a medical ward for a long-standing history of vague chest pain 4 weeks prior to admission.

Two days prior to admission he suffered left pulmonary infarct and 24 hours later developed an extensive left iliofemoral venous thrombosis.

At thrombectomy via the left common iliac vein a good channel was produced but a defect persisted in the common iliac vein (Fig. 70 - a). This was interpreted as residual common iliac thrombus though the possibility that it was due to adhesions was considered because of the rigid feeling imparted to the Fogarty catheter when it passed this point. No rethrombosis occurred over the next 10 days; the heparin/saline infusion was discontinued and the patient was mobilised. Four days later he sustained a right pulmonary infarct and bilateral venography by direct femoral puncture showed that thrombus in the common iliac vein had extended to involve the inferior vena cava (Fig. 70 - b).

Streptokinase to a total 4,000,000 units in 48 hours was administered via a left sapheno-femoral catheter and moderate lysis was produced (Fig. 70 - c). There was no further embolism and his general condition improved.

Follow-up venography 6 weeks later showed clear iliofemoral segments on both sides (Fig. 70 - d). Five weeks after his original episode of venous thrombo-embolism he was admitted with a right iliofemoral venous thrombosis without evidence of embolism. This was successfully managed by thrombectomy.

Comment

No rethrombosis occurred in the left iliofemoral segment over the 5

month period following streptokinase. During the first 3 months he continued on Warfarin. No cause was found for this man's recurrent thrombophlebitis.

This patient experienced a severe allergic reaction as soon as the streptokinase infusion was commenced. This took the form of fever, joint pains and nausea. Hydrocortisone produced dramatic relief.

APPENDIX VI

Case 5

Time	SK Dose	Thrombin Clotting Time (secs)	Fibrinogen Level (mg%)	Euglobulin Lysis Time (mins)	Plasmin-ogen (cu/ml)	Quick Prothrombin Time (secs)
-20 mins	4,000,000 u. streptokinase	24	500	400	3.00	20.5
3 hrs		37	370	55	0.00	22.0
18 hrs		45	340	65	-	19.5
25 hrs		30	340	40	-	19.0
42 hrs		31	360	50	-	19.0
66 hrs		22	320	120	2.00	16.5
120 hrs		-	540	-	3.25	-

Case 6

This 71 year old man suffered several pulmonary emboli over a period of 5 weeks. Bilateral femoral venograms showed extensive non-occlusive thrombus in both iliofemoral segments. Both sides were cleared through the common femoral veins. Partial rethrombosis occurred on the right side on the 7th postoperative day and streptokinase 2,830,000 units in 28 hours was administered via the right sapheno-femoral catheter. Clearance of the segment was complete in 6 hours.

Comment

A severe allergic reaction occurred after only a few drops of streptokinase had been infused. Hydrocortisone provided rapid relief.

APPENDIX VI

Case 6

Time	SK Dose	Thrombin Clotting Time (secs)	Fibrinogen Level (mg%)	Euglobulin Lysis Time (mins)	Plasmin-ogen (cu/ml)	Quick Prothrombin Time (secs)
-20 mins	2,850,000 u. streptokinase	17	410	>200	2.85	18
2 hrs		>180	170	15	0.00	32
9 hrs		150	145	20	-	32
26 hrs		>180	135	30	-	24.5
50 hrs		34.5	90	90	0.50	19.0
80 hrs		-	280	80	2.40	19.5

Case 7

This 52 year old man, with a long-standing tuberculous dorsal kyphosis and chronic bronchitis, developed a spontaneous left iliofemoral venous thrombosis 4 days before admission. There was no history of pulmonary embolism. Clearance at thrombectomy was incomplete in that non-occlusive common iliac thrombus persisted.

On the 4th post-operative day there was dramatic recurrence of leg swelling with venographic evidence of extensive rethrombosis.

5,000,000 units of streptokinase were infused over 48 hours via the sapheno-femoral catheter. Despite marked evidence of lysis over the first 24 hours clinical improvement was only slight. 24 hours after discontinuing streptokinase there was evidence of rethrombosis despite anticoagulant therapy in the form of heparin and warfarin and this progressed to complete occlusion over the next 5 days.

A large wound haematoma formed in this case and had to be aspirated. There has been no improvement in leg swelling over the subsequent 4 month period.

Comment

Despite a good early response to streptokinase, rethrombosis occurred while there was still laboratory evidence of fibrinolytic activity, and while on theoretically adequate anticoagulant therapy.

APPENDIX VI

Case 7

Time	SK Dose	Thrombin Clotting Time (secs)	Fibrinogen level (mg%)	Euglobulin Lysis Time (mins)	Quick Prothrombin Time (secs)
-20 mins	5,400,000 u. streptokinase	19.0	460	>300	12.5
3 hrs		55.0	380	30	15.5
26 hrs		38.0	360	35	14.5
44 hrs		49.0	320	25	16.0
54 hrs		48.0	300	35	15.5
90 hrs		30.0	360	>300	54.0

Case 8

This 64 year old man developed an extensive left iliofemoral venous thrombosis without any detectable cause. There was severe venous insufficiency but no evidence of pulmonary embolism.

Clearance at thrombectomy was almost complete although a slight irregularity due to mural thrombus was present in the final operative venogram.

Within 2 days extensive occlusive rethrombosis had occurred and streptokinase (3,750,000 units in 36 hours) was infused via the saphenofemoral catheter. Venography 24 hours after commencing streptokinase showed marked lysis with virtually complete clearance but rethrombosis occurred over the next 12 hours despite continuing therapy, becoming complate over the next 2 days.

48 hours after commencing streptokinase there was bleeding from the wound and this continued over the next 3 days despite discontinuing anticoagulant drugs. Haemoglobin fell from 70% to 36% over 3 days and blood transfusion was necessary because of the patient's poor general condition.

A large wound haematoma developed 7 days after streptokinase and this had to be evacuated, and the whole groin wound then broke down. Healing by secondary intention was slow but eventually complete.

When seen for follow-up 4 months after this episode the wound was sound and his general condition good. Severe venous insufficiency persisted.

Comment

Rethrombosis occurring while the infusion continued is difficult to explain and is discouraging. Laboratory results show that it was not due

to a fall in fibrinolytic activity, and the constant infusion pump prevents variable dosage. This case emphasizes again how important rethrombosis is and how difficult it is to manage.

Wound bleeding was very marked in this case. There was no detectable surgical error to account for this.

APPENDIX VI

Case 8

Time	SK Dose	Thrombin Clotting Time (secs)	Fibrinogen level (mg%)	Euglobulin Lysis Time (mins)	Quick Prothrombin Time (secs)
-20 mins	4,250,000 u. streptokinase	21.0	380	>540	15.5
5 hrs		35.0	360	55	14.5
26 hrs		41.0	260	18	16.5
46 hrs		35.0	240	50	19.0

Case 9

This 24 year old woman developed a left iliofemoral thrombosis 10 days after left salpingectomy for a ruptured tubal pregnancy. There was no history of pulmonary embolism. Bilateral femoral venograms demonstrated a left iliofemoral thrombosis with extension into the inferior vena cava.

Operative clearance was incomplete with residual common iliac and caval thrombus. Post-operative venograms showed rethrombosis of the iliac veins within 2 days.

Streptokinase (3,100,000 units over 28 hours) was infused via the sapheno-femoral catheter. Venograms over the next 5 days showed no evidence of thrombolysis.

This patient developed a moderate wound haematoma which settled after evacuation through a small incision.

Follow-up venography 6 weeks later showed complete external and common iliac occlusion with a developing cross circulation. Venous insufficiency in this case was only moderate.

Comment

This patient was the only one to show no evidence of thrombolysis with streptokinase. Her maximum reduction in fibrinogen was only 80 mg., and it would appear that she had an inadequate dose, although dosage was calculated on the same basis as in the other cases.

APPENDIX VI

Case 9

Time	SK Dose	Thrombin Clotting Time (secs)	Fibrinogen Level (mg%)	Euglobulin Lysis Time (mins)	Quick Prothrombin Time (secs)
-20 mins	3,100,000 u. streptokinase	25	320	310	16
3 hrs		17	320	17	15
18 hrs		35	240	25	15
30 hrs		40	250	35	16.5
48 hrs		40	280	17	15
80 hrs		55	270	20	15
90 hrs		22	—	180	15.5

APPENDIX VII

STREPTOKINASE IN ILIOFEMORAL VENOUS THROMBOSIS

Case 1

This obese 64 year old woman sustained several pulmonary emboli 3 weeks after a McMurray osteotomy of the left hip for osteoarthritis. She was severely dyspnoeic, blood-pressure was reduced from 166 mm.Hg. to 106 mm.Hg. systolic, and she was in incipient right heart failure. Bilateral femoral venograms showed non-occlusive thrombus in the right iliofemoral segment (Fig. 72a).

Thrombectomy was contraindicated by her obesity and her poor general condition. Streptokinase (2,000,000 units in 16 hours) was infused via a right sapheno-femoral cannula.

There was marked improvement in the patient's general condition within a few hours and her chest was completely clear in 48 hours. Venography showed complete lysis of the iliofemoral thrombus 8 hours after commencing the infusion.

The infusion was discontinued because of persistent oozing of blood from the groin wound. Despite anticoagulant therapy bleeding stopped and although a small haematoma developed the wound healed by first intention.

Comment

This patient's cardiopulmonary function improved dramatically with treatment, although objective evidence of this improvement is lacking.

No prophylactic steroids were given in this case and the patient had a moderate reaction to therapy. This was readily controlled with hydrocortisone.

APPENDIX VII

Case 1

Time	SK Dose	Fibrinogen level (mg%)	Euglobulin lysis time (mins)	Quick Prothrombin time (secs)
-20 mins	2,100,000 u streptokinase	800	>90	--
18 hrs		300	25	85
44 hrs		200	>90	63.8
72 hrs		300	>180	53.2

Case 2

This 63 year old man was admitted to a medical ward with a diagnosis of chronic bronchitis and incipient right heart failure. He had had 3 myocardial infarcts in the preceding 6 years, and had been in another unit six weeks previously with severe right upper quadrant abdominal pain when a diagnosis of cholecystitis was made. Just prior to the present admission he had experienced left infra-mammary pleuritic pain. Study of his previous records and X-rays showed no evidence of previous bronchitis. Shortly after admission he developed an extensive left iliofemoral venous thrombosis. He was referred to us 4 days later because of continuing chest and leg symptoms.

It was elected to treat him with streptokinase in preference to thrombectomy because of his poor general condition, the age of the occlusive thrombus and because it was felt that streptokinase might improve the pulmonary lesions. 1,600,000 units of streptokinase were infused via a left sapheno-femoral catheter. The infusion was discontinued after 12 hours because the patient suffered a severe asthmatic attack. Rapid and extensive thrombolysis resulted and continued till the venogram at 72 hours after commencing streptokinase showed complete clearance. Cardiopulmonary function showed only minimal improvement.

This man has had 3 subsequent episodes of mild cardiac failure not related to pulmonary embolism. His venous system appears intact, although he has never been fit enough for follow-up venography.

APPENDIX VII

Case 2

Time	SK Dose	Thrombin clotting time (secs)	Fibrinogen level (mg%)	Euglobulin Lysis time (mins)	Plasmin-ogen (cu/ml)	Quick Prothrombin Time (secs)
-20 mins	1,600,000 u. streptokinase	30	420	>300	2.82	17.5
3 hrs		120	360	40	0.00	19.0
24 hrs		360	350	150	0.70	18.6

Case 3

This 55 year old man with advanced lower motor neurone disease causing almost complete paralysis of the lower limbs suffered recurrent minor pulmonary emboli over a 3 month period. There was no clinical evidence of venous thrombosis and bilateral femoral venograms showed clear iliofemoral segments. Three days before the present admission he developed an extensive left iliofemoral venous thrombosis. Venography at this time demonstrated complete left iliofemoral venous occlusion.

Streptokinase (3,100,000 units in 29 hours) was infused via a left sapheno-femoral catheter. Venography demonstrated rapid thrombolysis so that at 6 hours from commencing the infusion there was a channel through the external and common iliac veins, with only minimal residual thrombus. However, despite continuing streptokinase the common iliac vein became occluded over the next 10 hours. Although the external iliac vein was virtually free of thrombus common iliac occlusion persisted and drainage was mainly via the ascending lumbar vein, this situation continuing until the sapheno-femoral catheter was removed.

Leg swelling decreased dramatically soon after the infusion was started and there was only minor recurrence when ambulation was attempted.

Comment

Up to 3 months no further rethrombosis has been detectable clinically. However, further rethrombosis must be expected because of the lack of mobility in the limbs and for this reason long term anticoagulant therapy with warfarin has been instituted.

APPENDIX VII

Case 3

Time	SK Dose	Thrombin clotting time (secs)	Fibrinogen level (mg%)	Euglobulin Lysis time (mins)	Plasminogen (cu/ml)	Quick Prothrombin time (secs)
-20 mins	3,100,000 u. streptokinase	25	560	>300	4.05	13.5
3 hrs		75	480	17	0.35	14.0
24 hrs		33	310	35	0.00	19.4

Case 4

This 50 year old man tore his left Achilles tendon 3 months before admission and was in bed for 6 weeks because of it. After returning to work he found that his left ankle was stiff and slightly swollen. 5 days prior to admission he developed intense thigh and calf pain and swelling. There was clinical evidence of an extensive left iliofemoral thrombosis. Bilateral femoral venograms (Fig. 73a) showed extensive left external iliac thrombosis with extension into the common iliac vein.

Streptokinase (2,700,000 units in 22 hours) was infused via a left sapheno-femoral catheter. Venography demonstrated very marked thrombolysis (c.f. Figs. 73b and c). At this stage streptokinase was discontinued but because the thrombin clotting time was so prolonged heparin was not given. Venography at 28 hours (Fig. 73d) showed marked rethrombosis while the thrombin clotting time was still elevated. Because of this heparin was commenced and 500 ml. of Dextran 70 was administered. Further lysis thereafter occurred until the whole segment was clear on the 11 day venogram (Fig. 73g).

This patient has continued on rigidly controlled warfarin therapy for a period of 3 months without tendency to rethrombosis.

Comment

This case illustrates how effective thrombolysis can be, and emphasises that the major difficulties are encountered in preventing rethrombosis.

Comparison of the thrombin clotting time and whole blood clotting time shows that the two do not correspond.

Saphenofemoral infusion	Time (hrs.)	Thrombin clotting time (secs)	Whole blood clotting time (mins)	Lysis/Thrombosis
↑ Streptokinase ↓	0	21	5	↑ Thrombolysis
	24	>120	6.5	↓ Rethrombosis
	28	48	7	
↑ Heparin	42	>120	22	↑
	68	>120	20	Thrombolysis
↓	75	50	15	↓

The fact that there was definite evidence of rethrombosis while the blood was incoagulable at test tube thrombin clotting estimation questions the reliability of this test as an index of anticoagulant activity in such circumstances. The explanation for this is not clear. It may be that fibrinogen degradation products (FDPs), although having sufficient heparin like activity to influence thrombin clotting time, are not active enough to deal with the vast excess of thrombin that is available as prothrombin in the circulating blood. It is of interest that both the quick one-stage prothrombin and the whole blood clotting which depend on endogenous thrombin were both normal in these circumstances.

Another possibility is that the rethrombosis observed on venography was a platelet phenomenon. Certain FDPs are known to increase platelet aggregability and Dextran 70 may have acted as an antagonist. Further study of this problem is required before any conclusion can be reached.

APPENDIX VII

Case 4

Time	SK Dose	Thrombin clotting time (secs)	Fibrinogen level (mg%)	Euglobulin lysis time (mins)	Plasmin-ogen (cu/ml)	Quick Prothrombin time (secs)
-20 mins	2,700,000 U streptokinase	21	610	600	4.13	14.2
1 hr		45	495	45	2.34	15.0
18 hrs		>120	130	17	0.00	24.0
24 hrs		>120	70	-	0.31	-
42 hrs		>120	270	100	1.40	20.0
68 hrs		100	390	-	3.19	20.0