tion of a widespread enteric infection. This hypothesis was based on a suggested similarity between the geographical distributions of poliomyelitis and multiple sclerosis, though no actual data were given. One essential for this hypothesis has been supplied by the present study, which has confirmed the relation between multiple sclerosis mortality, poliomyelitis notification rate, and latitude in Australasia. Data from the northern hemisphere did not demonstrate this relation, possibly because there were more potential complicating factors in this hemisphere, and these may have exerted a masking effect.

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Thrombosis of the Internal Jugular Vein in Congestive Cardiac Failure

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Examination of the jugular venous pulse has become an established part of clinical examination, especially since its importance was stressed by Wood (1950, 1956). Despite this, however, the discovery of jugular venous thrombosis is infrequent. It was first reported by William Hunter in 1757 as part of a more extensive thrombosis involving the superior vena cava, in association with an aortic aneurysm. In 1889 Ormerod described internal jugular thrombosis found at post-mortem examination of a case of mitral stenosis. Thrombosis was thought to have arisen in the right subclavian vein and spread to involve the internal and external jugular veins on both sides. It is of interest that he specifically mentions: ". . . a projecting end of clot hung into the superior cava but was not adherent there," and also, "there was no clotting in the cerebral sinuses." Since these early records most of the reported cases have occurred in association with sepsis in the ear or pharynx, usually with thrombosis of the cerebral sinuses or as a part of a "superior vena cava syndrome" where thrombosis of the cava is a sequel to intrathoracic disease (Beck, 1934; Stone and Berger, 1936; Gilmore, 1939; Flett, 1941; Smith, 1950; Schechter, 1954). Ciuti and Skinner (1955) described a case of thrombosis of the left internal jugular vein, with recovery, in a woman of 68 with congestive cardiac failure and a right pleural effusion of undetermined origin.

During March 1963 two patients were admitted to St. James' Hospital with congestive cardiac failure and thrombosis of the right internal jugular vein. A third case has since been seen at New End Hospital (Case 3).

Case 1

A 56-year-old woman complained of palpitations and increasing breathlessness for one month prior to admission to hospital. For one week she had noticed aching and some tenderness of the right side of the neck. In 1958, five years previously, she had been admitted with a myocardial infarction, confirmed by electrocardiograms, and followed by pulmonary embolism with effusion. There had been persistent tachycardia after this, and several episodes of congestive cardiac failure were treated with digoxin and diuretics. There was no history of ear disease at any time.

On examination she was dyspnoeic at rest and the jugular venous pressure was increased on the left. The right side of the neck was swollen and extremely tender. The thrombosed internal jugular vein was readily palpable as a solid cord, and some small, firm, mobile lymph nodes were present in the deep cervical chain. There was pitting oedema of the ankles. The pulse rate was 88 per minute, the blood pressure 140/90 mm. Hg, and the heart not clinically enlarged. There was a triple rhythm at the apex, but no murmurs were heard. Bilateral basal rales were audible in the chest.

In view of the presence of lymph nodes in association with the thrombosis of the internal jugular vein, exploration and lymph-node biopsy were carried out. The right internal jugular vein was found to be thrombosed and adherent to the surrounding tissues; nothing could be aspirated from it. There were several moderately enlarged lymph nodes adjacent to the vein. The histology of one of these showed non-specific reactive hyperplasia.

Examination in the E.N.T. department revealed no abnormality in the ears, nose, or nasopharynx. During this admission there was a brief episode of upper abdominal pain, severe, sharp in type, and without radiation. On examination there was deep epigastric tenderness but no other abnormal signs. Investigations, including barium-meal *x*-ray examination, serum amylase, and 24-hour urinary amylase, showed nothing abnormal. The pain settled spontaneously and there was no recurrence. When she was readmitted some 11 months later with a further myocardial infarction the neck was healed and there were no other abnormalities. Two months later the patient died in another hospital; no post-mortem examination was permitted.

Investigations.—Haemoglobin 13.2 g./100 ml.; W.B.C. 8,500/c.mm.; erythrocyte sedimentation rate 30 mm./1 hour (Wintrobe). Haematocrit, bleeding- and clotting-times, and platelet count were normal on several occasions. The serum cholesterol during the admission of 1958 was 325 mg./100 ml. This remained elevated, but the patient was not a diabetic and there was no evidence of

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myxoedema. Electrocardiograms showed an old myocardial infarction but no recent changes. An *x*-ray film of the chest was normal.

Case 2

A woman of 42 years, a known case of mitral stenosis with atrial fibrillation, presented in the out-patient department with a two-day history of pain and swelling in the right side of the neck and a one-week history of increasing dyspnoea on effort. Oedema of the ankles had recently developed.

In the past she had had rheumatic fever as a child. In 1959 exploration of the abdomen for bilateral hydronephrosis revealed bilateral aberrant renal arteries. These were divided and there had been no sequelae.

On examination she was dyspnoeic at rest and mildly cyanosed. There was atrial fibrillation at 140 per minute, the heart was not clinically enlarged, and there were the signs of a tight mitral stenosis without clinical evidence of mitral incompetence. The peripheral pulses were normal. In the chest there were diffuse rales, and in the abdomen the liver was enlarged. Marked oedema of the ankles was present on admission.

The left external jugular vein showed a slight increase in pressure but the right external jugular vein was distended to the angle of the jaw. The right side of the neck was swollen, red, and tender, and the right internal jugular vein was thrombosed. It was readily palpable as a firm cord which could be rolled under the fingers. No enlarged lymph nodes could be felt. The thyroid was normal to palpation. There was no abnormality in the ears, nose, or throat.

Progress.—Her congestive cardiac failure was controlled with bed rest, digoxin, and diuretics. The swelling and tenderness in the neck subsided without any specific treatment. Four weeks after admission she developed a thrombosis in the left axillary vein, with swelling of the arm and hand. She was treated with heparin for 10 days; the thrombosed vein became impalpable and the hand and arm returned to normal.

In September 1963 she was referred to the Hammersmith Hospital regarding suitability for valvotomy. She was thought to have pure tight mitral stenosis with a rather rigid valve and considerable pulmonary vascular disease. At the Joint Cardiac Clinic mitral valvotomy was recommended, and this was performed by Mr. Bentall on 23 September 1963. The valve was found to be rigid, distorted, and shrunken, with some calcification. Relief of symptoms was very satisfactory.

Investigations.—The bleeding- and clotting-times were normal before the beginning of anticoagulant therapy, and the platelet count was within the normal range on three occasions. Radiographs of the chest showed congestive changes, and on 10 May 1963 an area of consolidation with a small pleural effusion was reported. Pulmonary embolism was thought to be the most likely cause.

No cause for her thrombotic episodes was apparent at operation, and there was no recurrence.

Case 3

A 67-year-old woman was admitted to New End Hospital from a Christian Science House, where she had remained for several weeks without conventional treatment. She was too disorientated to give a history, and was breathless and cyanosed. There were a number of pressure sores over the buttocks and forearms. Clubbing of the fingers was present, and there was a malar flush. The tongue was red, dry, and sore.

The right external jugular vein was thrombosed and readily palpable; deeper palpation revealed the internal jugular vein on the same side also to be thrombosed. There was gross anasarca, with oedema of the feet, legs, thighs, and abdominal wall. The left thigh was more swollen than the right, and the femoral vein was thought to be thrombosed. There were the signs of consolidation at the left lung base. The pulse was irregular at 120 per minute, and the electrocardiogram confirmed atrial fibrillation. The blood-pressure was 110/60 mm. Hg. The apex of the heart was displaced to the sixth left intercostal space in the anterior axillary line, and a triple rhythm was heard. The liver was markedly enlarged, and ascites was present.

A diagnosis of gross untreated congestive cardiac failure with bronchopneumonia was made, the sequence of events not being known, and the patient was treated with digoxin, diuretics, anticoagulants, oxygen, and antibiotics, but made no response.

Investigations.—A chest radiograph showed a left pleural effusion with areas of consolidation at both bases, the blood urea was 142 mg./100 ml. Death precluded further investigation.

Post-mortem examination revealed pneumonic consolidation of the lower lobes of both lungs and some cardiac enlargement but no valvular lesions. Three gastric ulcers were found, one at the cardia and two on the lesser curve. There were a number of thrombotic manifestations: the right external and both right and left internal jugular veins were occluded by thrombus, which was unequivocally ante-mortem. There was no thrombus above the jugular foramen on either side, nor were there any thrombi in the cerebral venous sinuses. The superior vena cava was not thrombosed, but some thrombus was present in the left atrial appendage. In addition, there was thrombosis of the right cephalic vein and of the left femoral vein. No significant lesions were found in any other site, and the histological studies revealed no evidence of malignancy in the gastric ulcers.

Discussion

Phlebothrombosis of the veins of the leg has been the subject of many studies and several probable causative factors have emerged. A reduction in the rate of flow of blood through the vein and a change in its coagulability are perhaps the most important events predisposing to thrombosis. The same factors may well be relevant in the causation of thrombosis elsewhere in the body.

Reduced blood-flow in the leg veins of patients lying supine and motionless in bed has been clearly demonstrated (Frimann-Dahl, 1935; Payling Wright and Osborn, 1952; Dodd and Cockett, 1956), while studies on the activity of patients have shown that hospital admission is accompanied by an increase of 100% in the time spent in bed whether or not surgery is performed (Browse, 1964). Factors causing stasis in the upper half of the body, usually at least semivertical in posture, are less easily conceived, but compression of veins as by an aortic aneurysm or by gross enlargement of the cardiac chambers would seem possible. Sleight (1962) has shown that pressure on the left innominate vein by an unfolded aorta may give rise to unilateral elevation of the internal jugular pressure on the left but not on the right. Reduced cardiac output and a prolonged circulation time might contribute to slower venous flow. There was no evidence of mediastinal obstruction in any of the cases described, but all presented with increasing congestive cardiac failure.

Sharnoff (1959), studying blood coagulability in surgical patients, showed a rise in the platelet count and a reduction in clotting-time within a few hours of the start of an operation. It is of note that these changes were more pronounced under general than under spinal anaesthesia. A great increase in numbers of megakaryocytes in the lung tissue of patients dying after operation has been demonstrated. It seems possible that changes in the pulmonary circulation under conditions of general anaesthesia or when pulmonary congestion accompanies cardiac failure may be responsible for an increase in coagulability. In none of our cases could we show any increase in platelet counts above the normal in the peripheral blood, but it may be that adhesiveness as well as actual numbers of platelets is relevant, and studies of this kind were not undertaken. The spontaneous resolution of the condition in two of the three cases suggests that the factors involved may have been reversible on treatment of the cardiac failure. In none of the cases was any underlying neoplasm demonstrated.

Summary

Three cases of thrombosis of the internal jugular vein in association with congestive cardiac failure are described and the possible aetiology and pathogenesis discussed.

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Reduction of "Rebound" Hypercoagulability by Gradual Withdrawal ("Tailing Off") of Oral Anticoagulants

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There is a clinical impression that fresh thrombotic attacks are more likely to occur shortly after anticoagulant treatment is stopped. We have previously shown that there is "rebound" hypercoagulability in patients whose long-term anticoagulant treatment has been suddenly withdrawn (Poller and Thomson, 1964). An increase in both "extrinsic" and "intrinsic" systems of blood coagulation was found to be present one week after treatment was stopped, and this hypercoagulable state persisted for some time afterwards. Although the presence of abnormal coagulability is not synonymous with "rebound" thrombosis, it is obviously undesirable in a patient who has previously experienced a thrombotic episode. In this investigation we have studied the effect of gradual withdrawal of oral anticoagulants over a period of four weeks in a group of patients who had been on long-term therapy and compared the results obtained with a group of normal volunteers studied in parallel.

Method of Study

The discontinued group consisted of nine patients who had been on long-term therapy with nicoumalone (Sinthrome) for periods between 5 and 43 months, with a mean of 14 months. They were made up as follows: eight with myocardial infarction and one with thrombophlebitis.

The normal group consisted of seven healthy members of the staff of the department. Venepunctures were performed on this group at the same intervals and on the same day as on the discontinued patients. This was to ensure the stability of the reagent and the reproducibility of the tests over the period of study. In addition, data were available for analysis from recent studies performed on 80 other normal subjects, using the same techniques and reagents. The following tests were performed both on patients and on controls at each visit: prothrombin activity (Quick test), Factor VII assay, heparin plasma clotting-time, cephalin time, antihaemophilic globulin (A.H.G. ; Factor VIII).

The techniques were precisely the same as those used in the previous investigation (Poller and Thomson, 1964). The "tailing off" period was of four weeks' duration. The dosage schedule was as follows: the original full dosage was halved for the first two weeks, and then after two weeks on the reduced schedule it was again halved for a further two weeks—that is, one-quarter the original dose. The treatment was then finally stopped.

Results

Detailed results obtained in both the discontinued and the normal groups are given in the Table. On the final day of their period of full-dosage anticoagulant treatment the discontinued group showed a significant reduction of prothrombin activity and Factor VII activity. There was no significant alteration of the cephalin time or heparin plasma clotting-times. In contrast a significant increase in the concentration of Factor VIII was detected.

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Table of Results

Week	Group	P.A.		Factor VII Assay		Cephalin Time		Heparin Clotting-time		A.H.G. (Factor VIII) Assay					
										10%		20%		30%	
		sec.	S.D.	sec.	S.D.	sec.	S.D.	sec.	S.D.	sec.	S.D.	sec.	S.D.	sec.	S.D.
0	D	12·0	—	29·6	6·5	69	5·8	12·1	4·2	16·1	1·2	14·6	1·1	13·8	0·8
	C	21·4	5·7	20·4	1·7	69	4·1	10·2	2·6	18·5	1·2	16·3	1·3	14·0	0·9
1	D	12·0	—	24·5	3·6	64	2·4	9·0	2·4	16·7	1·3	14·8	1·0	13·9	1·0
	C	16·0	1·75	22·6	1·6	65	2·9	9·0	2·2	18·7	1·7	16·0	1·1	14·9	0·7
2	D	12·0	—	22·3	2·7	67·7	4·3	8·4	1·8	16·6	1·8	15	1·7	13·8	1·5
	C	14·6	1·5	19·7	1·3	69	3·1	10·9	3·0	18·8	1·0	16·2	0·9	15	0·6
3	D	12·0	—	21·3	2·0	62·6	3·9	6·7	1·6	16·8	1·5	15·3	1·3	14·3	1·1
	C	12·9	0·4	20·5	2·2	67	1·7	8·5	4	17·4	1·6	15·5	0·8	14·5	1·0
4	D	12·0	—	21	3·0	62·6	2·6	8	1·8	17·4	1·8	15·4	1·0	14·0	1·0
	C	13·4	2·6	19·4	1·2	66·8	5·3	10·8	2·9	18·1	1·0	16	0·4	15·2	0·8
5	D	12·0	—	20·5	1·2	64	3·6	8·4	2·1	17·7	1·1	16·3	1·2	15·3	0·3
	C	12·0	—	20·5	1·8	66·7	6·6	10·6	2·5	19	1·1	16·6	0·6	16	0·5

D = Discontinued. C = Control.