AORTO-ILIAC OCCLUSIVE DISEASE*

A REPORT ON 67 CONSECUTIVE CASES TREATED SURGICALLY

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(*Continued from page 350 of the* Journal *for 29 April 1961*)

SYMPTOMS AND SIGNS

Intermittent Claudication

Intermittent claudication was the outstanding symptom. It was present in every case and the first symptom in 64 (95%).

The term is derived from the Latin *claudicare*, to limp or halt,[16] and is usually defined as a discomfort of varying severity produced by exercising a muscle under ischaemic conditions, and rapidly relieved by rest.[22] (It was first described by the veterinary surgeon Boullay in 1831, who observed it in a six-year-old mare suffering from obliteration of her femoral arteries — when she trotted the blood-supply was insufficient and the result was '*une douleur profonde*'. The clinical picture was clearly described by Charcot in 1858.[22]) It is due to the fact that, when the circulation to a muscle is impaired, repeated activity causes it to outstrip its blood supply.

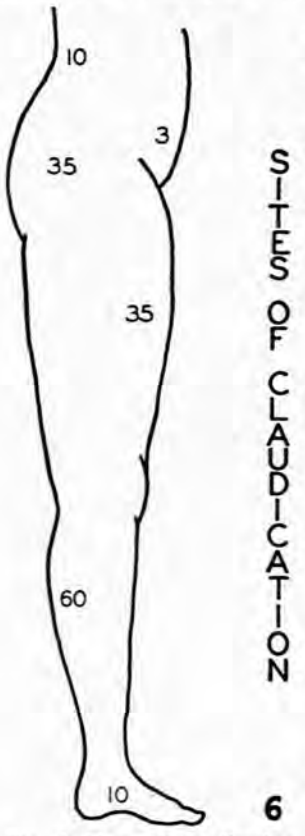

Fig. 6. Sites of claudication.

Unfortunately intermittent claudication has become synonymous with pain in the calf on walking and therefore variations, which are common, are often not recognized.[4,12,14] In the first place the symptom need not be a severe pain which is alarming to the patient. It may be a dull ache, a cramp or a burning sensation; it may simply be a discomfort, a tightness, a weakness or a feeling of profound fatigue; some patients describe it as a feeling 'as if the limb does not belong' to them. In aorto-iliac disease in particular a common complaint is 'an extreme weariness' first described by Leriche.[18]

In the second place, it may be located in any muscle which has its blood supply impaired during exercise. The intermittent claudication of aorto-iliac disease may occur in the back, hip or buttock, thigh or lower abdomen.[3,8,11,14,24] This may occur alone or in association with calf claudication, but when there is associated occlusion of the femoral or distal vessels, calf claudication often dominates the picture. The areas affected in our patients are shown in Fig. 6 and the clinical patterns are given in Table III. The following observations are of interest:

1. The outstanding symptom was pain or distress in the hips and/or thighs, particularly in patients with localized occlusions (86%).

2. Symptoms occurred at a high level (back, hip, thigh, abdomen) in 25 (89%) of the 28 patients with localized occlusions and in 44 (66%) of the series as a whole. On the other hand 60 (90%) of the patients had symptoms referable to the calves. De Wolfe *et al.*[11] found that 55·3% of their patients with localized occlusions had no symptoms below the knees, but this was so in only 4 (14%) of our 28 cases with similar lesions.

TABLE III. CLAUDICATION PATTERNS

	A	*AI*	*I*	*IF*	*AIF*	*Total*	*Remarks*
Number of patients	7	15	6	6	33	67	
Back, hip and thigh	—	2	—	—	—	2	Proximal to calves only
Thigh and/or hip	—	2	—	—	3	5	Proximal to calves only
Back, hip, thigh, calf	1	1	—	—	4	6	
Back and calf	—	1	—	—	1	2	
Hip, thigh and calf	4	4	2	1	4	15	Hypogastric pain in 1
Hip and calf	1	2	1	2	1	7	Hypogastric pain in 2
Thigh and calf	1	2	1	—	3	7	
Feet and/or calf	—	1	2	3	17	23	Femoral involved in 20 (87%)

Arteries involved: back—aorta, hip—aorta or common iliac, thigh—external iliac, hypogastrium—internal iliac, and calf—femoral or external iliac.
Grades of claudication: grade 1, 3; grade 2, 11; grade 3, 53.
A=aortic bifurcation, AI=aortic bifurcation + common iliacs, I=iliac vessels (common, internal or external iliac), IF=iliac + common and superficial femoral, and AIF=aortic bifurcation + iliac + femoral.

3. In 23 (34%) of the patients distress was limited to the calves. However, 20 of these had associated femoral occlusions. Of the 28 with localized occlusions only 3 (10%) had symptoms in the calves alone.

4. There was associated backache in 10 cases (15%) and lower abdominal pain in 3 (4%). Others[14] have reported cases where low back pain was the initial and major symptom.

5. It may be concluded that aorto-iliac occlusion usually gives symptoms referred to the region of the hips and thighs with radiation to the calves. This is occasionally accompanied by backache and rarely by abdominal discomfort.

In the early stages the distress would involve only 1 limb or group of muscles and would come on only after violent exercise or walking long distances. Gradually other muscle groups and the opposite limb would become involved and the claudication distance would become progressively less. At first the patient would find that the symptoms subsided with further exercise (grade 1 — 3 cases); later there would be no relief but they could still force themselves to carry on (grade 2 — 11 cases); finally

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the distress would become so intense that they found it impossible to continue walking (grade 3 — 53 cases). Eventually the walking distance might be reduced to 10 - 15 yards (the effort of standing upright might even be sufficient to produce the distress), and the time of rest required for the distress to abate would become progressively longer. At this stage there were also other symptoms and signs of ischaemia.

Rest Pain (Table IV)

Rest pain was present in only 18 (27%) patients and 14 of these had involvement of the femoral vessels. This is in keeping with the objective findings mentioned below.

Major Ischaemic Effects (Table IV)

Major sequelae of ischaemia such as sensory disturbances, trophic changes, ulceration and gangrene were uncommon and occurred in about a quarter of the patients. Of these, 4 out of 5 had femoral involvement. This was pointed out by Leriche[18] and has been confirmed by all subsequent reports.[8,11,14,29] Ulceration and gangrene were particularly rare (10 patients) and occurred in only 1 of the patients with localized disease. In this patient an indolent ulcer followed trauma to the leg and was in fact the first symptom. In this connection it is of interest that Leriche[18] warned that 'if an incision is made in the limb the wound heals very sluggishly or not at all'. It is this absence of major ischaemic effects that has led to many mistakes in diagnosis for, as Leriche[18] points out, 'it is difficult to believe that the circulation is impaired'. Further confusion may arise in those rare cases where ischaemia of the spinal cord may result in alteration of the tendon jerks and other signs suggestive of orthopaedic disorders.

TABLE IV. CLINICAL FEATURES—LOCAL

Features	*Subjective* (*Patients*—67)	*Objective* (*Limbs*—129)	*Remarks*
Claudication	67	—	Only proximal to calves in 7 (10·5%)
Rest pain *	18	—	Femoral involved in 14 (78%)
Sensory disturbances*	27	19	Femoral involved in 16 limbs (84%)
Trophic changes*	13	17	Femoral involved in 14 limbs (82%)
Ulcers and gangrene*	10	10	Femoral involved in 9 limbs (90%)
Colour changes	20	46	Pallor in 16 limbs, cyanosis/rubor in 30 limbs
Positive Goldflam's sign	—	62	
Coldness	36	58	
Wasting	—	34	
Impotence	13	—	Internal iliacs involved in all

* Four out of 5 patients with rest pain and ischaemic changes had femoral involvement.

Coldness (Table IV)

Coldness, both subjective and objective, occurred in about 50% of patients irrespective of the type of occlusion. It should be regarded as an important feature and was the first symptom in 2 patients. In some patients it was associated with Raynaud's phenomenon in winter or when the feet were immersed in cold water.

Colour Changes (Table IV)

Colour changes were noted in about a third of the patients. Cyanosis or rubor was twice as common as pallor which, however, has been stressed by Leriche and others as an important feature of aorto-iliac occlusion. Only rarely did we see the striking pallor giving the skin the ivory or marble-like appearance, with thin blue veins, described by Leriche. This is in keeping with the findings of de Wolfe. On the other hand, Goldflam's test was positive in 50% and in these patients extreme pallor was noted during the test. It is generally agreed that this test is of value and will show a positive result when the earliest symptom of claudication appears.[16]

Wasting (Table IV)

Muscular wasting was noted in about one-third of the patients and these complained especially of loss of power or fatigue on exercise. Leriche found 'global' atrophy to be common, but mentions that it may be difficult to appreciate because both limbs are affected. Others have also commented on wasting which may at times be extreme.[8] Certainly some of these limbs looked as if they were made of skin and bone only. Lesser degrees of wasting may be missed because of the lack of a normal limb for comparison.

Impotence (Table IV)

Leriche laid great stress on impotence in the male, referring to the symptom as an 'inability to keep a stable erection, the blood flow being insufficient to fill the spongiosus processes'. He continued that 'if the disease is left to itself, sexual impotency will soon be permanent' and pointed out that 'genital troubles are more noticeable (in patients who are still young) since they appear in full youth'. The accuracy of Leriche's description should be noted — the symptom is *not* 'loss of libido' as is sometimes stated.[29]

The symptom was present in 13 (30%) of our male patients, and a similar incidence has been found in other series.[8,29] All of them had bilateral disease involving the common and internal iliac vessels, which supports the presumption that the symptom is due to impairment of the blood supply to the corpora cavernosa through the internal pudendal artery.[29] None of the patients had evidence of 'spinal-cord claudication', bladder dysfunction or testicular atrophy.

Pulses (Table V)

Aortic pulsation above the umbilicus could be felt in all the patients. The presence of a bruit over the terminal aorta was recorded in 10 patients, but the actual number was probably greater because this sign was not always carefully looked for, especially in the earlier cases.

TABLE V. PERIPHERAL PULSES

	A	*AI*	*I*	*IF*	*AIF*	*Total*
Number of cases	7	15	6	6	33	67
Aortic bruit	—	6	—	—	4	10
Number of limbs:						
iliac	14	30	8	11	66	129
femoral	—	—	—	8	55	63
Femoral pulses:						
present	9	22 (br. in 9)	5	9 (br. in 4)	42 (br. in 13)	87
absent	5	8	3	2	24	42
Popliteal pulses:						
present	6	13	3	3 (br. in 3)	11	36
absent	8	17	5	8	55	93
Pedal pulses:						
normal	4	9	4	—	5	22 *
diminished	2	9	1	1	7	20 *
absent	8	12	3	10	54	87

* Limbs without femoral involvement—66, pedal pulses in 42 (64%); limbs with femoral involvement—63, pedal pulses in nil.
A, AI, I, IF, AIF as in Table III; br. = bruit.

Femoral pulses were present in two-thirds of the limbs, but were often weak and tended to disappear with exercise. Bruits were recorded in 26 (20%), but unfortunately, the vessels were not auscultated after exercise. Popliteal pulses were present in 36 (28%) of the limbs and bruits were recorded in 3.

Pedal pulses were present in 42 (33%) of the limbs, but in half of these they were diminished, i.e. they were either of poor volume or 2 of the 3 pedal pulses (dorsalis pedis, posterior tibial, perforating peroneal) were absent or they disappeared on exercise. Significantly, pedal pulses were present in 64% of the limbs without femoral occlusion and in none of those with femoral occlusion.

The presence of pulses in so many of our patients is in keeping with the rarity of rest pain and major ischaemic changes. It is a feature which, although recorded in reported case histories, is not stressed in the literature.[8,11] Leriche [18] stated that 'no pulse can be found, either in the leg or in the groin'. It is therefore important to emphasize that both groin and pedal pulses may be present in complete occlusions of the aorta and iliac arteries. It should be mentioned, however, that the pulses tend to disappear on exercise[1] and if the patient is examined soon after a period of activity, no pulses may be felt.

Associated Cardiovascular Disease (Table VI)

There was evidence of associated cardiovascular disease (excluding hypertension) in 38 (58%) of the patients, particularly among those who had diffuse disease. A high incidence has also been reported by others,[3,8,28,29] and the common associated lesion is coronary heart disease. This is a factor which obviously affects prognosis and it should be noted that 6 of our patients developed postoperative coronary thrombosis.

Carotid bruits were recorded in only 10 patients. Although there were no histories of carotid insufficiency, this figure is probably low because the carotid vessels were not always auscultated, particularly in the earlier cases, and recently we have found that bruits are often present. In none of the patients in this series was there obvious evidence of involvement of the brachio-cephalic trunks. More recently, however, we have treated 3 women, aged 28, 29 and 40 years, suffering from diffuse aorto-ilio-femoral disease, who also had involvement of the aortic arch with stenosis of the common carotids and subclavian arteries.

TABLE VI. ASSOCIATED CARDIOVASCULAR DISEASE

	A	*AI*	*I*	*IF*	*AIF*	*Total*
Number of patients	7	15	6	6	33	67
Number with cardiovascular disease	3	8	2	5	20	38
History:						
Coronary	—	3	1	—	4	8
Angina	—	—	—	—	2	2
Failure	—	2	—	2	6	10
Stroke	—	—	1	1	1	3
Thrombo-embolism	1	—	1	1	1	4
Examination:						
Cardiac signs	—	2	1	—	5	8
Carotid bruit	—	1	—	3	6	10
Special:						
Abnormal ECG	1	5	1	2	12	21
Retinopathy	—	—	—	—	4	4
Albuminuria	—	—	—	—	3	3
Postoperative:						
Coronary	1	2	—	2	1	6
Renal failure	—	—	—	—	1	1

A, AI, I, IF, AIF as in Table III.

None of the patients in the series had obvious involvement of the renal or superior mesenteric vessels, but in one of the patients mentioned above there was stenosis of the origin of the left renal artery due to an atheromatous plaque. Furthermore, in another patient in the series there was severe postoperative oliguria with renal failure which might have been due to renal-artery obstruction.

It has been stated that thrombophlebitis and pulmonary embolism are frequently associated with aorto-iliac disease.[13] Four of our patients gave a history of thrombo-embolism. In 2 it followed on prolonged bed rest for

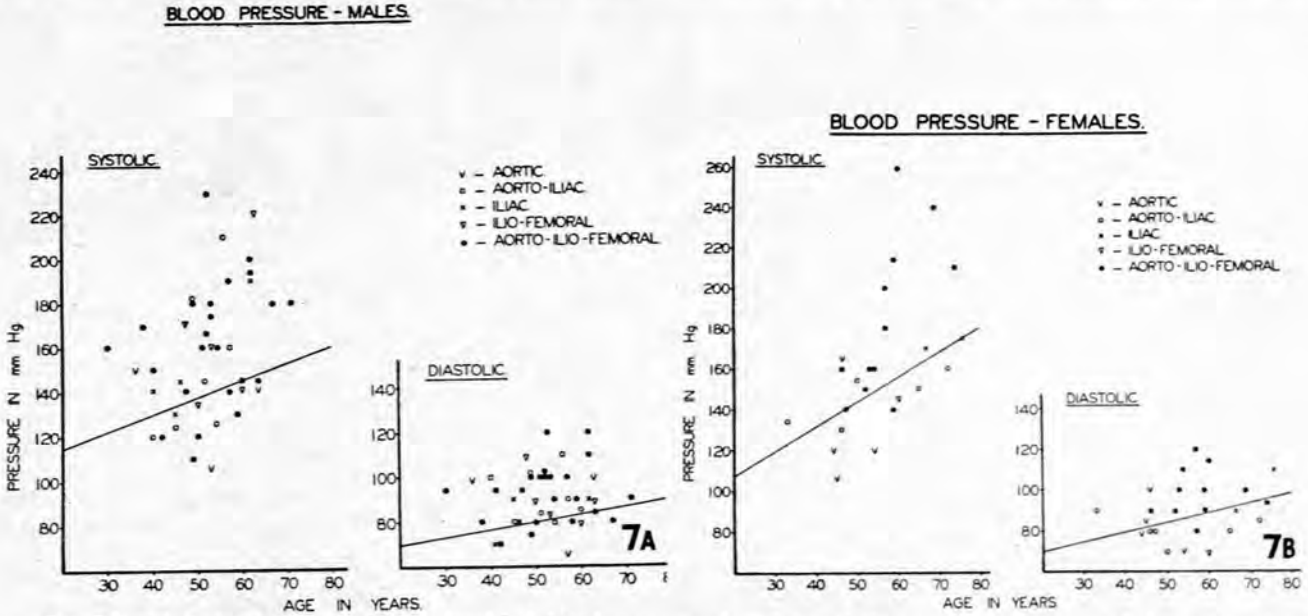


Fig. 7A and B. Scattergrams showing levels of blood pressure plotted in relation to the mean normal for age and sex (Pickering[22]).

coronary thrombosis, in 1 it followed a previous lumbar sympathectomy, and in the fourth it occurred spontaneously. In none of them was there any recurrence. None of our patients suffered from superficial phlebitis although varicose veins were common. It should also be noted that only 10 of the patients had haemoglobin levels above 16 G. per 100 ml. and that none were anaemic.

Blood Pressure (Figs. 7A and 7B)

Hypertension was not particularly common in the series as a whole. The diastolic pressure was below 90 mm.Hg in 23; from 90 to 100 in 20; from 100 to 110 in 14; from 110 to 120 in 6, and above 120 in 4. However, there was a tendency for both systolic and diastolic pressures to be raised in the males at all ages (Fig. 7A).

In both males and females with diffuse aorto-ilio-femoral disease, hypertension was common. In this group the diastolic pressure was below 90 mm.Hg in 6; from 90 to 100 in 11; from 100 to 110 in 9; from 110 to 120 in 3; and above 120 in 4. Figs. 7A and 7B show that in practically all the patients both systolic and diastolic pressures were above the average for the age-group. It was in this group with diffuse disease that the aortic disease often extended up to and beyond the renal arteries and in some, at least, the hypertension might have been caused by narrowing of a renal artery from extension of the aortic thrombosis. However, none of the patients suffered from malignant hypertension, and, unfortunately, the renal arteries were often not visualized on the aortograms. (A more recent case of renal hypertension associated with diffuse aorto-ilio-femoral thrombosis has already been referred to.)

Serum Cholesterol (Figs. 8A and 8B)

The blood-cholesterol levels were determined in 50 patients. Figures varied from 155 to 374 and in 23 of the patients the level was above 300 mg. per 100 ml. (In a more recent case the serum cholesterol was 420 mg. per 100 ml.) From Figs. 8A and 8B it will be evident that there is a tendency for the cholesterol levels to be raised, equalling and even exceeding those in patients with coronary thrombosis. It should also be noted that only 3 patients in the series had diabetes, which is in keeping with the findings of others. Twenty-two of the patients were very obese.

It is remarkable that the cholesterol levels were particularly high in patients with localized segmental aortic or iliac occlusion, because in them the rest of the aorta and the iliac vessels were apparently normal and associated coronary heart disease uncommon. This paradox may have a bearing on the aetiology of localized lesions and is being investigated further. De Wolfe *et al.*[11] have also found a high incidence of abnormal lipoprotein patterns.

DIAGNOSIS

1. The first essential in diagnosis is to remember the possibility of aorto-iliac occlusion in the differential diagnosis of discomfort in the back, hip, thigh or leg. Arterial obstruction must be considered in every patient who presents with low back pain, either alone or in conjunction with pain in any part of the limbs — even if the appearance of the limb does not suggest that the symptoms are of vascular origin.

2. Secondly a careful history must be taken to determine the relation of the discomfort to exercise. A history of intermittent claudication is highly characteristic of vascular insufficiency and can always be elicited on careful inquiry. The pain or discomfort comes on after walking a given distance and is usually distressing enough to cause the patient to stop. It is rapidly relieved by rest, but when activity is resumed the same amount of effort constantly reproduces the same pain in the same place.[11,10] The walking distance may vary, however, being decreased by a rapid pace or walking uphill, and increased by walking slowly.

No condition other than arterial insufficiency exactly reproduces this sequence. It was clearly recognizable in all our patients and we have found it so reliable that we hesitate to make a diagnosis of arterial insufficiency unless it is present.

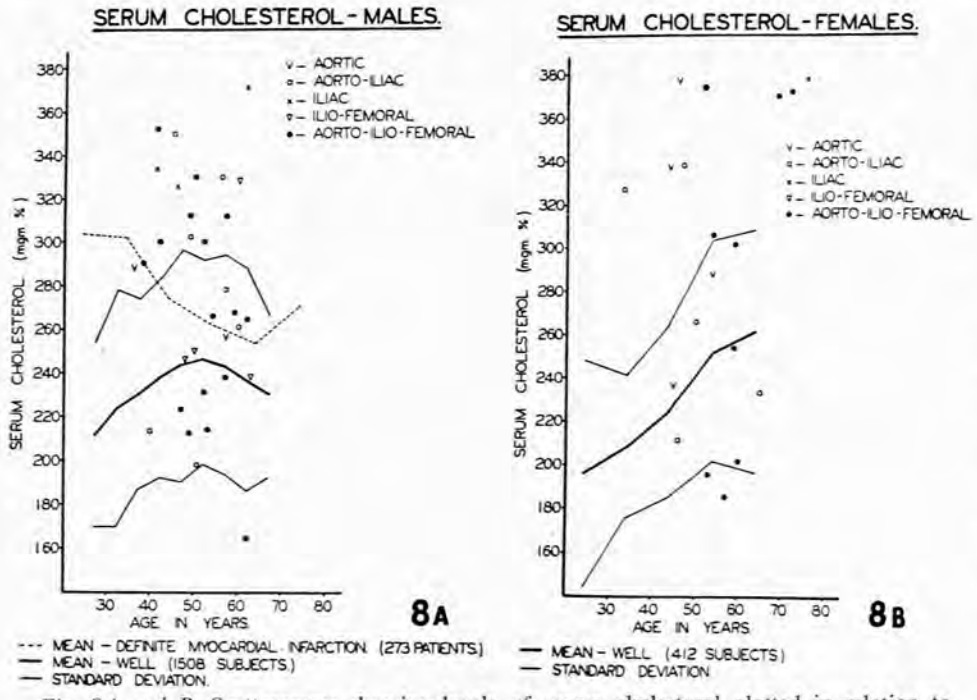


Fig. 8A and B. Scattergrams showing levels of serum cholesterol plotted in relation to the mean levels in well subjects and in patients with definite myocardial infarction (Lawry *et al.*[17]).

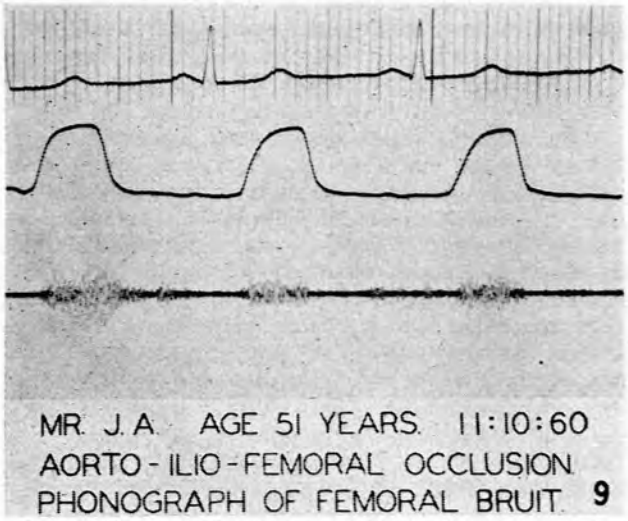


Fig. 9. Phonograph of femoral bruit (lowest tracing), together with electrocardiogram and recording of opposite femoral pulse.

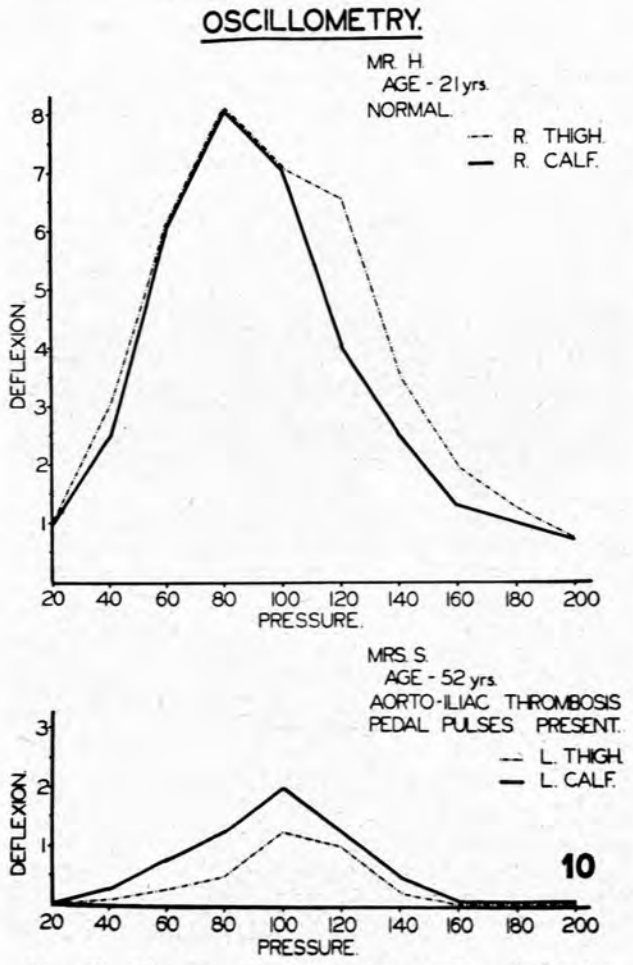


Fig. 10. Diagram of oscillometry readings indicating marked reduction in oscillation in thigh and calf of Mrs. S. (lower graph) although the pedal pulses were present. Compare with normal readings (Mr. H. — upper graph).

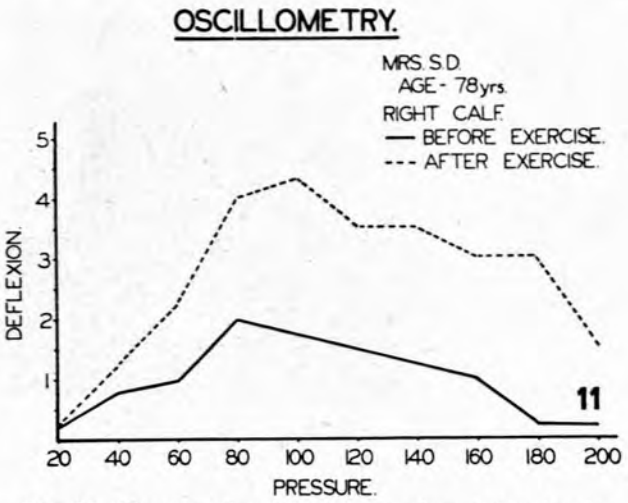


Fig. 11. Diagram of oscillometry readings indicating increased oscillation after exercise, due to shunting of blood to the muscles.

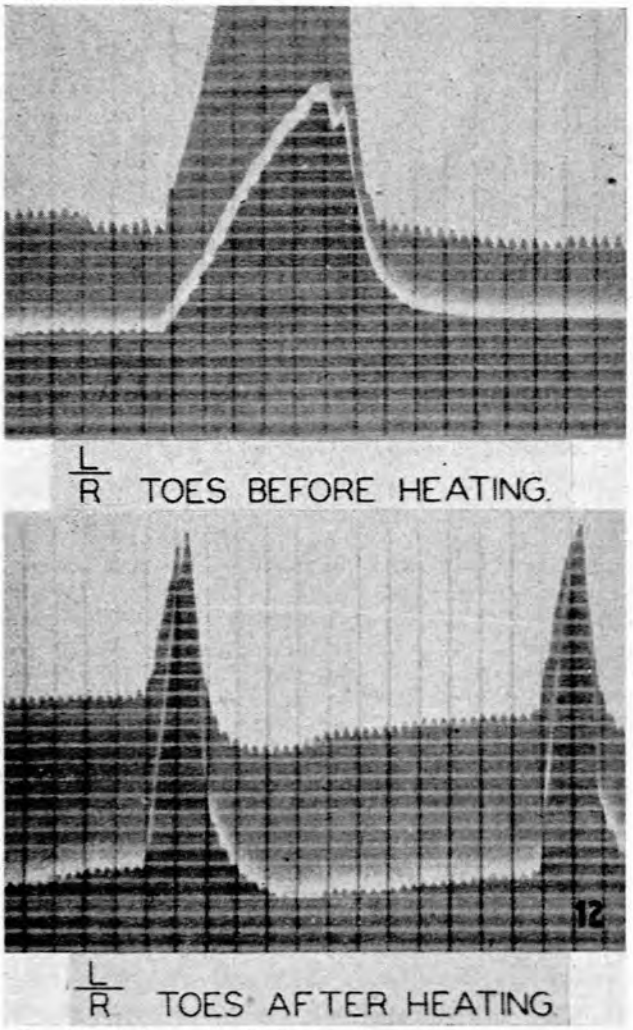


Fig. 12. Plethysmograph showing improvement in skin circulation after reflex heating in a patient with complete occlusion of the aortic bifurcation and absent ankle pulses.

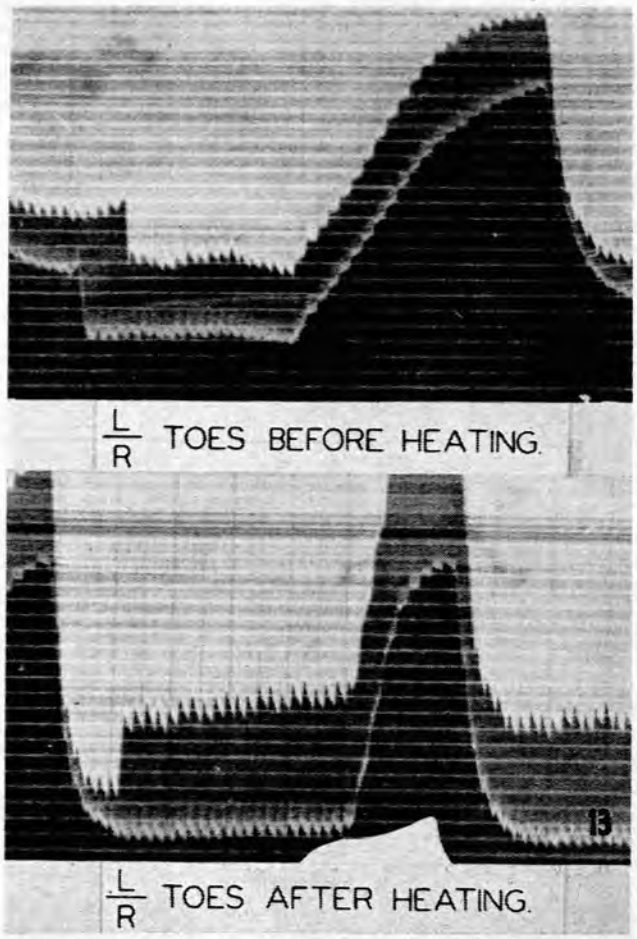


Fig. 13. Plethysmograph showing apparently good circulation although the patient had a complete block at the bifurcation of the aorta, with palpable ankle pulses. This may be misleading.

The character and distribution of the pain, on the other hand, may simulate very closely the symptoms of orthopaedic disorders.[4,11,14,15] Unlike the pain of prolapsed disc and other intrinsic disease of the back, however, ischaemic pain does not occur on the first movement but only after continuation of activity. Furthermore, it is not aggravated by coughing nor accompanied by an alteration in the tendon reflexes. In contrast to the pain of hip-joint disease, gluteal or thigh claudication is not associated with restriction of joint movements, nor are there areas of tenderness, trigger points or pain on passive movement usually found in fibrositis, bursitis and other soft-tissue affections which can be relieved by blocking with local anaesthetics. The same applies to the differentiation of calf and foot claudication from arthritis of the knee joint, foot strain and other bone and joint disease of the lower leg. It should be remembered, however, that a patient with arterial deficiency and exercise pains in the legs might also have osteoarthritis of his knee and hip and some metatarsalgia. He will describe his pain as an ache which came on with exercise in his whole limb, became worse throughout the day, and kept him awake at night.[6]

3. Thirdly, examination of the femoral and peripheral pulses should be made a routine and integral part of every orthopaedic examination. This should be done regardless of the appearance of the limbs, which are often remarkably normal.

Absence of the pedal pulses is an important sign of vascular disease, but occurs in only half to two-thirds of patients with aorto-iliac occlusion (depending on the extent of the disease). Diminished pulsation may be detected in a further sixth and these will usually show the inverse response described by Ejrup, the pulses becoming impalpable after exercise to the point of pain. In the remaining sixth the pulses will be normal although Ejrup's test may result in their diminution or disappearance. Michael Boyd[7] stated that disappearance of the pulse on exercise and return with rest is pathognomonic of a high arterial block.

Examination of the pulses should include auscultation of the aorta, iliac arteries and particularly the femorals before and after exercise. The presence of a bruit, which may be present only after exercise, indicates arterial stenosis and may be found in either the affected or the sound limb[15,20] (Fig. 9). It is of particular value in patients

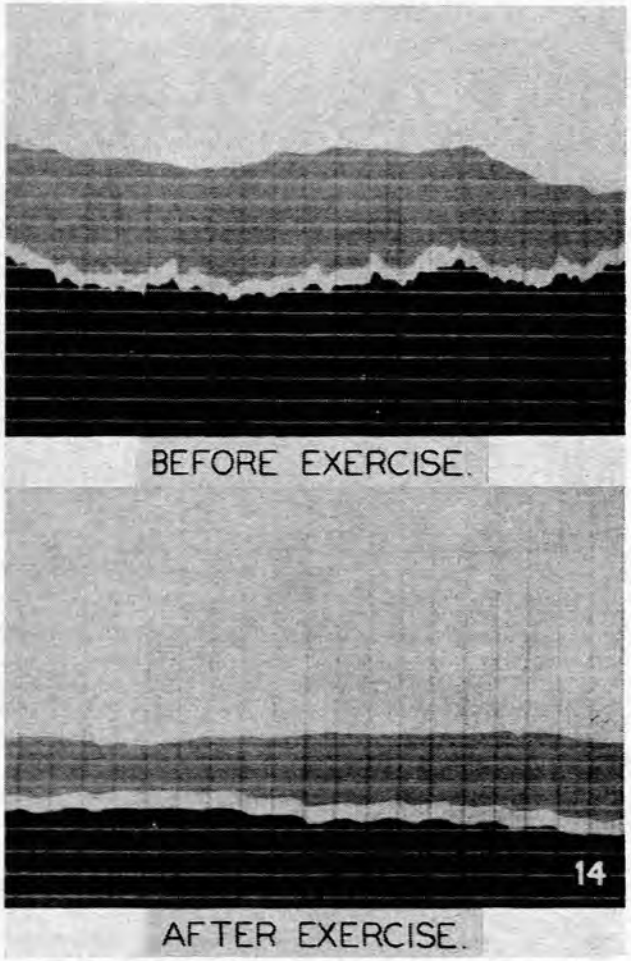


Fig. 14. Plethysmograph showing diminution of pulsation after exercise.

with palpable pedal pulses. (In complete occlusions no bruit can be heard over the artery itself but may be detected over large collaterals.)

4. Oscillometry is a valuable aid to diagnosis[8] particularly when the pedal pulses are present. Leriche recognized the importance of this investigation and mentioned that early 'good cases' can be detected on oscillometric examination. All our cases, including those with palpable pulses, showed reduction or absence of oscillations in the thigh and leg (Fig. 10). Furthermore oscillometry may show an increase in calf pulsations on exercise due to shunting of blood from the periphery to the muscles (Fig. 11).

5. Plethysmography is of much less value and may be misleading. In patients with severe ischaemia and absent pulses the diagnosis is obvious, and plethysmography is only of value in indicating whether the skin collaterals are capable of dilatation (Fig. 12). In others, particularly those with palpable pulses, the investigation may suggest that vascular obstruction is not the cause of the patients' symptoms (Fig. 13). Sometimes re-examination after exercise may show that the pulses disappear (Fig. 14).

6. Plain radiographs. These are of little value in the diagnosis of aorto-iliac thrombosis.[11,29] Aortic or iliac calcification was detected in 11 of our patients (Fig. 15). None of those with localized iliac occlusion and only 1 with localized aortic occlusion showed the presence of calcification.

Femoral calcification was present in 1 of these 11 patients and in 7 others. Among these 7 were 3 of the 6 patients with ilio-femoral occlusions and 3 patients who had aorto-iliac occlusion but perfectly patent femoral vessels.

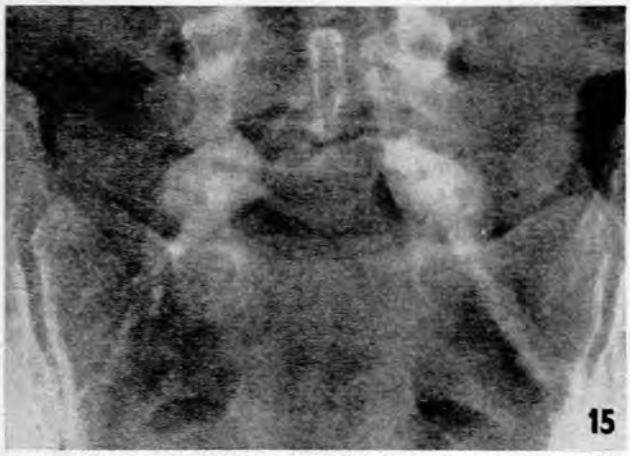


Fig. 15. X-ray showing calcification of common iliac arteries.

7. Aortography (Figs. 16 - 20) is the most useful investigation and was done in all but 4 of our patients. In 1 of those not investigated, aortography was deemed too risky because of extensive aortic calcification. In the other 3 the clinical diagnosis was considered definite enough to omit aortography.

We found aortography particularly valuable for the detection of the following:

(*a*) The exact location of the block, e.g. it differentiates between thrombosis of the lower aorta and bilateral com-

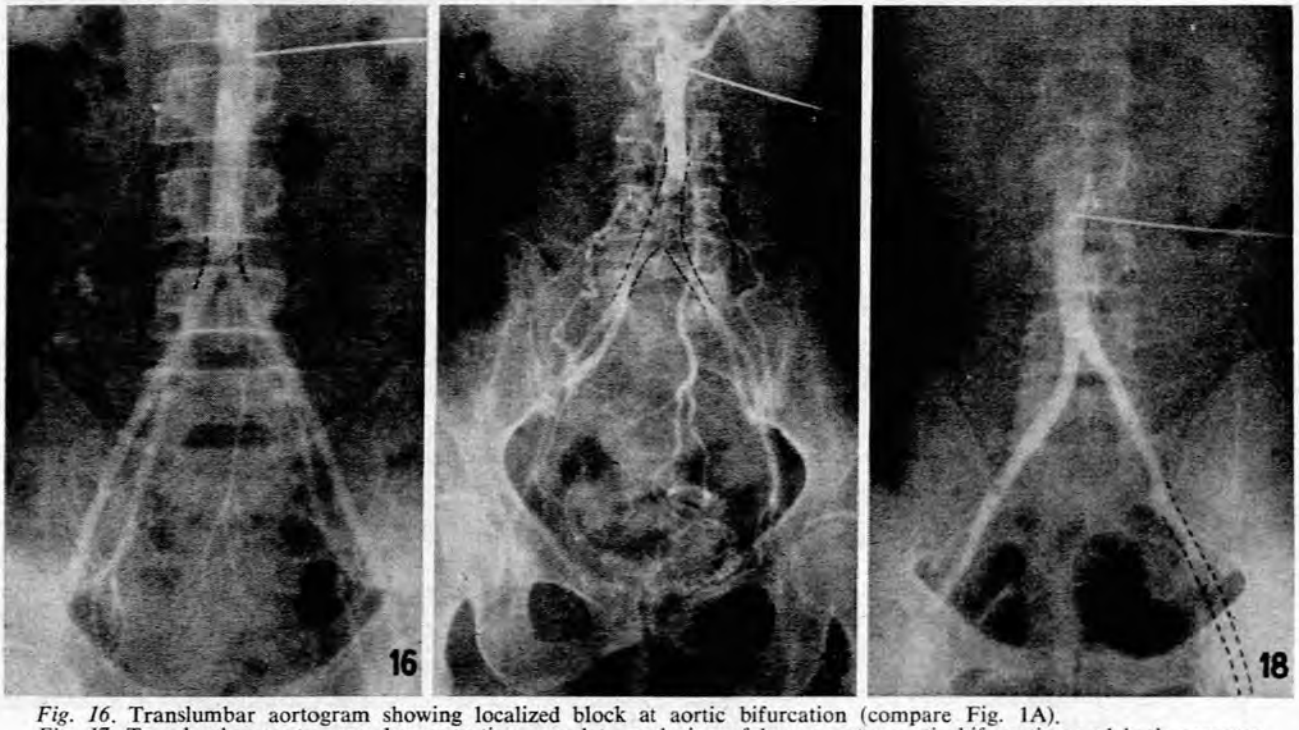
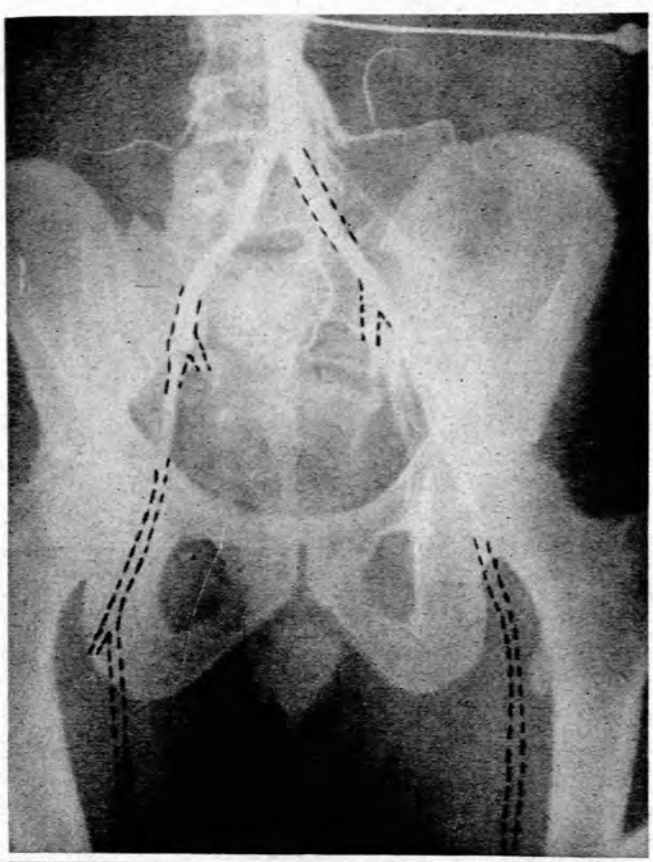
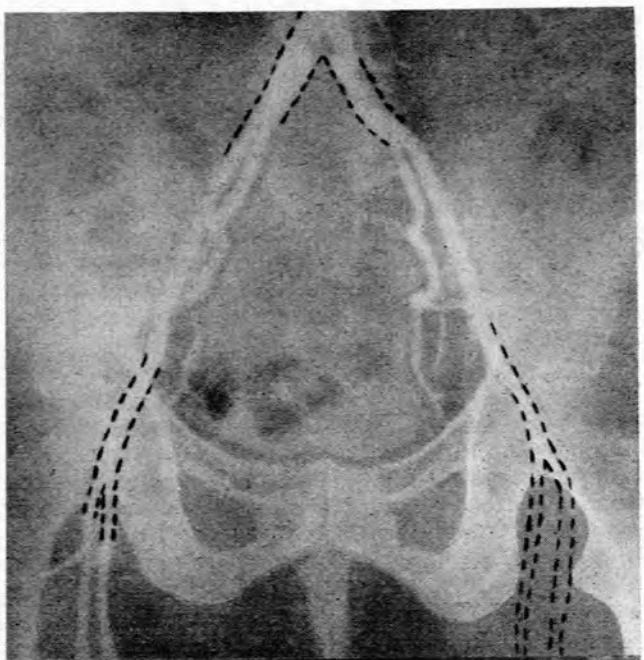


Fig. 16. Translumbar aortogram showing localized block at aortic bifurcation (compare Fig. 1A).
Fig. 17. Translumbar aortogram demonstrating complete occlusion of lower aorta, aortic bifurcation and both common iliac arteries. (Compare Fig. 1D).
Fig. 18. Translumbar aortogram showing complete occlusion of left external iliac artery. (Compare Fig. 1B).





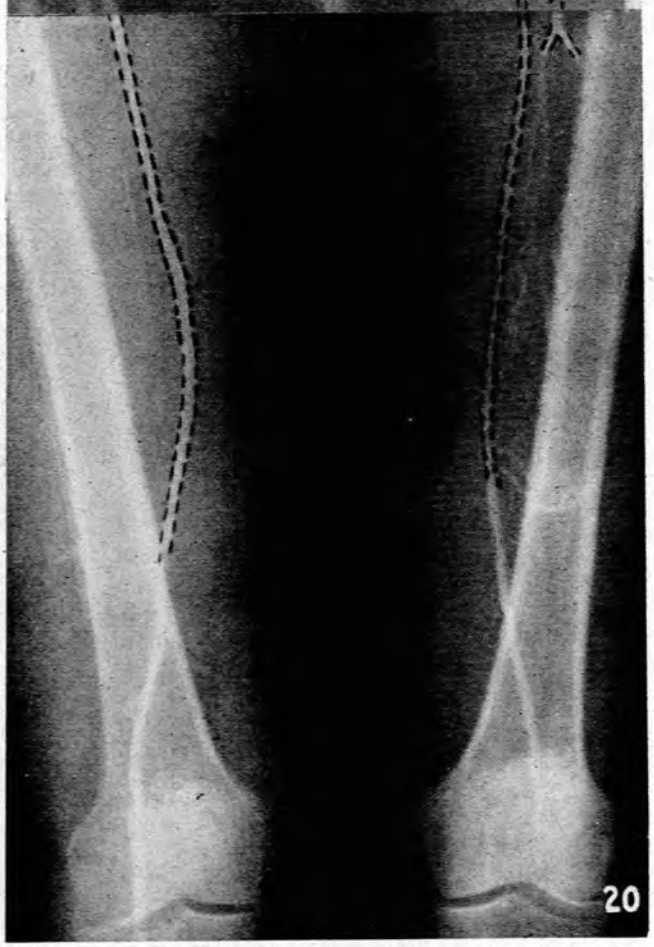


Fig. 19. Translumbar aortogram demonstrating multiple occlusions of aortic bifurcation, iliac arteries and both femoral (Compare Fig. 1C). Note: horizontal white band represents break in continuity of thighs.
Fig. 20. Translumbar aortogram demonstrating multiple occlusions of the iliac arteries and both femoral arteries and profunda femoris arteries. (Compare Fig. 1E).

mon iliac thrombosis and indicates the extent of the disease.

(*b*) Involvement of the renal arteries.

(*c*) Additional blocks in the femoral and distal leg vessels which are of great importance in assessing the 'run off' and hence the treatment and prognosis.

(*d*) The extent of collateral vessels, which will be discussed in another publication.

We are fully aware that the investigation is not without its dangers and that it should not be lightly undertaken by 'occasional dabblers',[29] but we have been fortunate in that none of the patients in this series suffered any complications. We therefore feel justified in continuing with aortography. If symptoms are so mild that operation is not indicated, then an aortogram is not advised since it is felt that aortography is an aid in planning the extent of surgery, not in deciding whether it is indicated.[12]

(To be continued)