OBLITERATIVE DISEASE OF THE ABDOMINAL AORTA
AND IliAC ARTERIES WITH INTERMITTENT
CLAUDICATION

By ALAN KEKWICK, LAWSON MCDONALD, AND ROBERT SEMPLE
(From the Department of Medicine, The Middlesex Hospital, London)

With Plate 4

Benjamin Brodie (1846) described obliteration of the iliac artery in two illustrative cases of senile gangrene, and Charcot (1858) based his original description of intermittent claudication on a patient in whom he had found at necropsy an aneurysm and obstruction of the common iliac artery. Obliterative arterial disease affecting vessels proximal to the inguinal ligament has been recognized since then as a possible cause of this symptom, but references in the literature to obstruction of the iliac arteries are few. Chabanier and Porin (1932) reported a patient with gangrene of the extremities and absence of pulsations in the legs on oscillography, who at post-mortem proved to have thrombotic obliteration of both common iliac vessels. Linton (1943) described a case of sudden thrombosis of the left external iliac artery. This event followed an operation for the removal of an ovarian tumour, when the left internal iliac artery was tied. The patient made a good recovery, and two and a half years later complained only of some fatigue of the left leg after walking one mile. Leriche (1946) discussed cases of iliac arterial obstruction, and Leriche, Kunlin, and Boély (1950), in a paper on aortography, showed several examples of the condition, without giving clinical details. Allen, Barker, and Hines (1946) stated that occlusion of the iliac arteries might be a cause of intermittent claudication, but did not record its incidence or give details of their cases. Lindbom (1950), in a careful radiological study, found it in 8 per cent. of 76 patients with intermittent claudication. Boyd, Ratcliffe, Jepson, and James (1949) and Boyd (1950), in a series of 1,000 cases of intermittent claudication, did not report obstruction of the iliac arteries. Thrombosis of the external iliac artery following lower abdominal injury in young men has recently been described by Boyd and Jepson (1950). In their cases recovery was rapid and the outlook was good, presumably because, in the absence of chronic arterial disease, an excellent collateral circulation developed. References in the literature to obliterative disease of the abdominal aorta have been more numerous. Graham, in a communication to the Medico-Chirurgical Society of London in 1814, referred to a pathological specimen belonging to Allan Burns which showed the aorta and iliac vessels plugged with laminated clot; no clinical details of the case were given. Welch, in 1909, collected from the literature 59 examples of obstruction of the lower abdominal

1 Received June 20, 1951.

Quarterly Journal of Medicine, New Series XXI, No. 82, April 1952.
186 A. KEKWICK, L. MCDONALD, AND R. SEMPLE

aorta. Of these he ascribed 45 to embolism and 14 to thrombosis. The cases of embolism occurred mainly in patients with mitral stenosis, producing the striking clinical picture which follows saddle-embolism of the aortic bifurcation. In some cases of thrombosis the onset was insidious, with numbness of the legs and intermittent claudication. In 1943 Greenfield fully reviewed the literature: he collected 161 previously published cases, and added five of his own. Leriche (1940, 1946) and Leriche and Morel (1948) described in detail the clinical picture of thrombotic obstruction of the aortic bifurcation, a syndrome which is often called by his name. The symptoms in his cases characteristically occurred in both legs. In the last 10 years many cases of lower abdominal aortic obstruction have been described (Keith and Horton, 1940; Lueth, 1940; Cleland, 1944; Diamond, 1945; Paul, 1947; Price and Wagner, 1947). Recently Elkin and Cooper (1949) described 10 cases seen within a period of 20 months.

Examination of 53 consecutive cases of intermittent claudication led us to conclude that arterial obstruction above the inguinal ligament is more common than previous reports suggest. It occurred in eight (15 per cent.) of 53 consecutive patients with intermittent claudication whom we examined, and we were allowed by the courtesy of colleagues to see three other cases. We re-examined the clinical findings in this group of patients, to determine whether they differed from the findings in patients with intermittent claudication due to obliterative arterial disease affecting the vessels distal to the inguinal ligament. We describe below the 11 cases examined, our methods of investigation, and the criteria for the diagnosis of the condition, with a note on treatment and on some of the problems presented. We have divided the 11 cases into two groups:

1. A group of eight cases in which the diagnosis was proved either by aortography (seven cases), or by arteriographic demonstration of normal lower-limb vessels in the presence of unequivocal evidence of obliterative vascular disease (one case). Of these eight, seven were cases of iliac and one of aortic obstruction.

2. A group of three cases in which the diagnosis rested on clinical and tonoscillographic evidence. These were cases of iliac arterial obstruction.

Methods of Investigation

General. In addition to a complete clinical examination, radiographs of the chest, pelvis, hip joints, and legs were carried out in all cases. A full blood count, Wassermann reaction, urine examination, and determination of the vital capacity, blood-urea, and blood-cholesterol were routine procedures. No reference to these investigations is made in the case reports unless the results were abnormal.

Tonoscillography after exercise. This investigation was carried out with Ejrup's tonoscillograph (Ejrup, 1948; McDonald and Semple, 1952) which graphically records the pulsations in a limb every 30 seconds. Recordings are taken at the ankle, calf, and thigh before and after exercise. Normal subjects show an increased amplitude of pulsations after exercise (normal reaction), but patients with arterial obstruction show a disappearance or decrease of pulsations distal to the site of obstruction (inverse reaction).

Aortography. Aortograms were taken in seven cases in the series. Under
general anaesthesia 20 to 30 ml. of 70 per cent. diodone were injected directly into the abdominal aorta through a posterior approach. Details of the method used have been described by Semple and Whiteside (1951).

**Femoral arteriography.** Femoral arteriograms were performed by Dr. David Sutton. The femoral artery was punctured percutaneously, and one or more injections of 20 ml. of 42 per cent. diodone were made, after which serial radiographs of the thigh and leg were taken.

Case reports are given in the Appendix, and the clinical features of the 11 cases are summarized in the Table.

**Discussion of Clinical Features**

In the following discussion only those patients (Cases 1 to 8) will be considered in whom the diagnosis was considered to be proved. The clinical features of these cases, and of the other group (Cases 9 to 11), are shown in the Table. Of these eight cases seven occurred in male patients, and the range of age was from 45 to 64 years. This age and sex incidence is similar to that found in cases of intermittent claudication due to obliterative arteriosclerosis of the vessels of the leg.

**Symptoms and signs.** The presenting symptom in all cases was intermittent claudication; its duration when the patients were first seen varied from seven months to three years. Pain was present in the calf in all cases (100 per cent.), in the thigh in six of the eight cases (75 per cent.), in the foot in five cases (62 per cent.), and in the buttock in only one case (12 per cent.). The two patients who did not suffer from pain in the thigh had had their activities much reduced by the occurrence of gangrene of the toes. In contrast, 43 cases of intermittent claudication due to obliterative arterial disease of more distal vessels showed an incidence of thigh pain of 25 per cent. The pain was in all cases ischaemic in type, coming on only on walking and disappearing after rest. Leriche (1946) stated that patients with obstruction of the iliac artery may suffer from pain in the buttock on walking, but this occurred in only one (Case 3) of our cases. Boyd and Jepson (1950), describing two cases of thrombosis of the external iliac artery in young men, noted that they complained of pain in the calf and thigh on walking. Halsted (1912), after tying the common iliac artery for aneurysm, was able to follow his patient’s progress for three years. He recorded pain and weakness of the affected leg on walking as being the main symptom. Pain in the calf and hip was present in all the cases of aortic thrombosis described by Elkin and Cooper (1949), but Leriche (1940) and Leriche and Morel (1948) found weakness on walking to be the more prominent symptom. This weakness of the legs is referred to by other workers in cases of iliac arterial obstruction (Linton, 1943; Boyd and Jepson, 1950). In aortic obstruction it was reported as a prominent feature by Elkin and Cooper (1949). A sense of weakness was not a notable symptom in our patients, being present in two (Cases 3 and 4); in the others, if it occurred at all, it was overshadowed by pain. Impotence due to inability to maintain erection was the presenting symptom in many of
### Table of Main Clinical, Arteriographic, and Tonosillographic Features

<table>
<thead>
<tr>
<th>Case number</th>
<th>Age (years)</th>
<th>Sex</th>
<th>Duration of symptoms when first seen</th>
<th>Site of pain on walking: side of lesion</th>
<th>Pulses (side of lesion):</th>
<th>Wasting (side of lesion):</th>
<th>Nutritional changes:</th>
<th>Femoral, popliteal, and leg vessels shown by arteriography</th>
<th>Tonosillography after exercise (side of lesion):</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>45</td>
<td>M</td>
<td>1 year</td>
<td>Right</td>
<td>0</td>
<td>+</td>
<td>0</td>
<td>Normal</td>
<td>No pulsation Inverse reaction</td>
</tr>
<tr>
<td>2</td>
<td>54</td>
<td>M</td>
<td>1½ years</td>
<td>Left</td>
<td>0</td>
<td>+</td>
<td>0</td>
<td>Normal</td>
<td>No pulsation Inverse reaction</td>
</tr>
<tr>
<td>3</td>
<td>58</td>
<td>M</td>
<td>7 months</td>
<td>Left</td>
<td>0</td>
<td>+</td>
<td>0</td>
<td>Normal</td>
<td>No pulsation Inverse reaction</td>
</tr>
<tr>
<td>4</td>
<td>64</td>
<td>M</td>
<td>2 years</td>
<td>Right</td>
<td>0</td>
<td>+</td>
<td>0</td>
<td>Normal</td>
<td>No pulsation Inverse reaction</td>
</tr>
<tr>
<td>5</td>
<td>53</td>
<td>M</td>
<td>3 years</td>
<td>Right</td>
<td>0</td>
<td>+</td>
<td>0</td>
<td>Normal</td>
<td>No pulsation Inverse reaction</td>
</tr>
<tr>
<td>6</td>
<td>64</td>
<td>M</td>
<td>2½ years</td>
<td>Right</td>
<td>0</td>
<td>+</td>
<td>0</td>
<td>Normal</td>
<td>No pulsation Inverse reaction</td>
</tr>
<tr>
<td>7</td>
<td>52</td>
<td>M</td>
<td>3 years</td>
<td>Right</td>
<td>0</td>
<td>+</td>
<td>0</td>
<td>Normal</td>
<td>No pulsation Inverse reaction</td>
</tr>
<tr>
<td>8</td>
<td>60</td>
<td>M</td>
<td>3 years</td>
<td>Right</td>
<td>0</td>
<td>+</td>
<td>0</td>
<td>Normal</td>
<td>No pulsation Inverse reaction</td>
</tr>
<tr>
<td>9</td>
<td>62</td>
<td>M</td>
<td>10 years</td>
<td>Right</td>
<td>0</td>
<td>+</td>
<td>0</td>
<td>Normal</td>
<td>No pulsation Inverse reaction</td>
</tr>
<tr>
<td>10</td>
<td>75</td>
<td>M</td>
<td>4 years</td>
<td>Right</td>
<td>0</td>
<td>+</td>
<td>0</td>
<td>Normal</td>
<td>No pulsation Inverse reaction</td>
</tr>
</tbody>
</table>

* ± Indicates that the pulse was weaker than the corresponding pulse on the other side.
Leriche’s cases of aortic obstruction (Leriche, 1940, 1946; Leriche and Morel, 1948), but Elkin and Cooper (1949) noted it in only half of their cases. Our patient with aortic obstruction did not complain of it.

Details of the main physical findings in our patients are shown in the Table. The femoral pulse was absent on the affected side in two cases, and on both sides in the patient with aortic obstruction. In the remainder the pulse, though palpable, was weaker on the affected side and was perceptibly delayed. Pulses distal to the femoral were generally not present, except in one case in which all were present and in one where the posterior tibial pulse could be felt. Nutritional changes of the toe-nails and of the skin of the feet were present in four patients, one of whom had gangrene of the toes and two (one the aortic case) developed indolent ulceration; the remaining patient had thickening and distortion of the toe-nails. In aortic obstruction Leriche (1940, 1946) emphasized the absence of nutritional changes in the feet, but this finding was not confirmed by Elkin and Cooper (1949). In this connexion the work of Halsted (1912) is of interest. He analysed 30 reported cases in which the common iliac artery had been ligated, mainly for aneurysm, and in two only was the occurrence of gangrene directly attributable to the ligation. In our series it is perhaps worth noting that in the three cases in which there were known to be no changes in the limb vessels there were no nutritional changes of the feet. In six of our seven proved cases of iliac arterial obstruction slight but definite wasting and hypotonia of the buttock on the affected side was apparent, and in five there was a reduction in the circumference of the affected thigh, varying from a half to one inch, compared with the normal side. The remaining patient was bedridden with gangrene, and these signs were not sought. Thus there was an incidence of buttock wasting and hypotonia of 100 per cent., and of thigh wasting of 83 per cent., of the cases in which these signs were sought. Examination of 14 proved cases of femoral or popliteal arterial obstruction indicated that these signs might be useful in the diagnosis between such obstruction and arterial obstruction proximal to the inguinal ligament. Thus of 14 proved cases of femoral or popliteal arterial obstruction, wasting of the thigh was evident in only three. Twelve of these 14 patients were examined for wasting of the buttock, and in only one was wasting and hypotonia present. Leriche (1946) mentioned hypotonia of the buttock as occurring in patients with iliac arterial obstruction, but stated that wasting of the thigh may be lacking. The same author described a ‘global atrophy’ of both legs in the aortic bifurcation syndrome. Of our seven proved cases of iliac arterial obstruction, two patients had symptoms and clinical signs of oblitative arterial disease of the other leg; in four the opposite leg, though symptom-free, showed tonosillographic changes after exercise which were indicative of femoral or popliteal arterial obstruction; only one had no evidence of arterial disease in the other leg.

Tonosillography after Exercise

This was carried out, as described, in six of the cases of iliac arterial obstruction. The remaining patient was too ill, and the patient with aortic obstruction
FIG. 1. Tonoscillograms recorded from the lower part of the thigh before and after exercise in a normal person (A), a patient with femoral arterial obstruction (B), and a patient with iliac arterial obstruction (C) (Case 2).
had no recordable pulsations in the legs. In all six there was a prolonged disappearance, or diminution in the magnitude, of pulsations after exercise (inverse reaction) at the ankle, calf, and thigh on the affected side. All of 12 patients with femoral arterial obstruction similarly examined showed, in comparison, inverse reactions at the ankle and calf; ten had normal reactions at the thigh after exercise. In the remaining two there were inverse reactions at the thigh, but these were of much shorter duration than in the cases of iliac arterial obstruction. In Fig. 1 are shown tracings from the thigh before and after exercise in a normal subject, in a case of femoral arterial obstruction with an inverse reaction at the thigh, and in a case of iliac arterial obstruction.

**Aortographic and Arteriographic Findings (Plate 4, Figs. 2, 3)**

Abdominal aortography was carried out in seven of the eight patients. In four there was complete obstruction of one or other common iliac artery at the point of origin from the aorta, and in the fifth there was gross narrowing at the same level. The sixth case showed narrowing of the common iliac artery and complete obstruction of the external iliac artery. In five cases there was some filling, via collaterals, of the external iliac or femoral arteries distal to the obstructed area. In the seventh case the aorta was presumed to be obstructed, though the actual level of the block was not shown because the films had not been taken high enough. There was no filling of the aortic bifurcation, though the inferior mesenteric artery was filled, and there was no periarterial collection of contrast medium. In five of the patients with iliac arterial obstruction the lower inch of the aorta was much narrowed, and in two of the others the appearances suggested marked atheroma of the aorta. Femoral arteriograms were carried out in three of the cases in the series, including two in which iliac arterial obstruction had been directly demonstrated, and in all three the femoral, popliteal, and the upper parts of the tibial arteries were shown to be normal.

**Diagnosis**

In patients with intermittent claudication there may be several features which suggest the diagnosis of arterial obstruction above the inguinal ligament. Pain on exercise extending high into the thigh, an imperceptible, weak, or delayed femoral pulse, and wasting of the thigh and buttock on the affected side are important. Nutritional changes may be absent. Obstruction of the common iliac artery is compatible with palpable pulses throughout the leg (Case 5). In aortic obstruction impotence may be the presenting symptom. A prolonged inverse reaction at the thigh on tonoscillography after exercise will make the diagnosis almost certain, even without arteriographic confirmation. In intermittent claudication which is due to femoral or popliteal arterial obstruction, pain in the thigh is less common, the femoral pulse is neither weakened nor delayed, wasting of the thigh and buttock is generally absent, and on tonoscillography after exercise a normal response is obtained at the thigh.
Treatment

Treatment was conservative in all our cases except two. One of these two patients had a bilateral amputation for gangrene, and one (Case 2) a modified thoraco-lumbar gangliectomy. In this latter case the ultimate result is not yet clear. Of the six patients treated conservatively none had deteriorated, and two had shown slight improvement, in the short period of follow-up. Lumbar gangliectomy, with or without the removal of the thrombotic segment, has been advocated and carried out by other workers (Leriche, 1940, 1946; Leriche and Morel, 1948; Elkin and Cooper, 1949; Boyd and Jepson, 1950). In this connexion it is perhaps a valid point that two physicians included in the series of Elkin and Cooper (1949) refused operation on the grounds that their symptoms were not sufficiently severe to warrant it. Reboul and Laubry (1950) performed 'disobliterative endarterectomy' in cases of major arterial obstruction, removing the intima and part of the media with the clot, and reported six cases in which this operation had been performed in ilio-femoral arterial obstruction. Of these six endarterectomies three remained patent up to 28 months after operation. This operation may prove useful in the relief of arterial obliteration, although its effectiveness may be limited by the generalized nature of the arterial disease. But the possibility of this or other types of arterial surgery (dos Santos, 1947; Holden, 1950; Lian and Welti, 1950) makes the accurate location of the site of arterial obstruction in these patients increasingly important.

Discussion

The occurrence of arterial obstruction above the inguinal ligament in eight cases out of 53 consecutive cases of intermittent claudication is evidence of its frequency. It is possible, as suggested by Boyd and Jepson (1950), that cases of intermittent claudication with normal thigh- and leg-vessels which in the past have been labelled as 'angiospastic claudication' were cases of aortic or iliac arterial obstruction. A patient reported by Lindqvist (1945) as a possible example of angiospastic claudication was later shown on aortography to have proximal arterial obstruction (Lindqvist, 1948). The condition results from extensive atherosclerosis of the iliac arteries and lower end of the aorta. Observation in the autopsy room shows that this is a common site of severe atherosclerosis. Leriche (1946) suggested that thrombotic obliteration of the aortic bifurcation might begin as a thrombosis of one or other common iliac artery. Certainly in two of our patients (Cases 4 and 6) there was narrowing of the last inch of the aorta, and in all the remaining arteriographed cases the obstruction was situated at the origin of the affected common iliac artery. The symptoms are not more severe than those found in obliterative arterial disease affecting the more distal vessels. The collateral circulation in obstruction of the common iliac artery was well described by Linton (1943). He pointed out that occlusion of the common iliac artery alone appears to be much less serious in its effects than when the external iliac artery is also involved. In the former case a good collateral circulation develops via the anastomoses in the pelvis between
OBLITERATIVE DISEASE OF THE ABDOMINAL AORTA

the internal iliac arteries, and then by retrograde flow up the ipsilateral internal iliac into the external iliac artery. Other collateral channels are via the superficial and deep epigastric arteries to the external iliac and femoral arteries, and via the lumbar and iliolumbar arteries, through the deep circumflex iliac artery, to the lower part of the external iliac artery. There are also collateral channels through the haemorrhoidal arterial system. The prognosis in these cases is better than would at first seem likely in the presence of such a major arterial obstruction. Leriche and Morel (1948) observed their patients from one to four years after sympathectomy, and all remained well. In the series described by Elkin and Cooper (1949) symptoms had been present for two to 12 years. The duration of symptoms in the present series varied from seven months to three years, and the patients are still under observation.

Acknowledgements

We wish to thank the members of the Consultant Staff of the Middlesex Hospital, and Dr. J. W. Pauley of Ipswich, for kindly referring cases to us, and Dr. David Sutton who performed the femoral arteriograms.

APPENDIX

Case Histories

Group 1. Cases in which the diagnosis was proved either by aortography or by arteriography (Cases 1 to 8).

Case 1. Male, aged 45. Publican

First seen in March 1950, with one year's history of ischaemic pain on walking in the front of the right ankle, and in the lower leg and thigh. He had fractured his right tibia and fibula in 1941. He smoked 20 cigarettes a day. On examination he was a heavily built man. The blood-pressure was 110/70 mm. Hg. All pulses except the popliteal were felt in the left leg; the right femoral pulse was palpable, but weak compared with the left. No pulses were felt distal to the femoral in the right leg. There was wasting and drooping of right buttock. The right thigh was half an inch less in circumference than the left; the circumference of the calves was equal. No nutritional changes were seen in the nails or in the skin of the feet. There was muscle-tenderness of the right calf and thigh. Physical examination was otherwise negative.

Investigations

Tonosclillography after exercise. Prolonged disappearance of pulsations at the right calf and thigh.

Radiography. Some calcification in the right iliac and left posterior tibial vessels.

Aortography. Complete occlusion of the right common iliac artery at its origin, extending distally for about two inches; internal and external iliac arteries filled through collaterals. The iliac arteries on the left side, and the aorta, appeared normal.

Femoral arteriography. Normal femoral, popliteal, and tibial vessels.

Treatment. He was treated conservatively, and advised to stop smoking. Ten months later his symptoms and general condition were unchanged.
Case summary. A case of complete occlusion of the right common iliac artery with normal vessels in the thigh and leg.

Case 2. Male, aged 54. Librarian

First seen in January 1951, with 15 months' history of ischaemic pain on walking in the right foot, calf, and thigh, and occasionally a dull ache in the same area at night. He smoked 20 cigarettes a day. On examination he was slightly obese. The blood-pressure was 130/80 mm. Hg. All pulses except the popliteal were felt in the left leg; only the posterior tibial pulse was felt on the right side. There was hypotonia of the right buttock, but no apparent wasting. The circumference of the right thigh was half an inch less than that of the left; that of the left calf was three-quarters of an inch less than the right. There was tenderness of the calf muscles on both sides. No nutritional changes were seen in the nails or skin of the feet. Physical examination was otherwise negative.

Investigations

Tonoscillography after exercise. Prolonged disappearance of pulsations at the right ankle, calf, and thigh (Fig. 1).

Radiography. Calcification in both femoral arteries.

Femoral arteriography. Normal right femoral, popliteal, and tibial arteries.

Aortography. Irregularity of the lumen of the aorta, and gross narrowing of the right common iliac artery at its origin, through which there was poor filling of the iliac and femoral arteries. Left iliac arteries normal.

Treatment. The right 11th and 12th thoracic and 1st lumbar sympathetic ganglia were removed by Miss D. Beck, as preliminary tests had shown a maximal rise in skin-temperature of the right foot when the 11th and 12th thoracic ganglia were infiltrated with procaine. It is still too early to assess the ultimate result, but when the patient was last seen two months after operation there had been little improvement in walking capacity.

Case summary. A case of partial occlusion of the right common iliac artery with normal vessels in the thigh and leg.

Case 3. Male, aged 58. Office messenger

First seen in August 1950, with a seven months' history of ischaemic pain on walking in the left thigh and leg. There was occasional pain in the left buttock on climbing hills. There were no other symptoms. He smoked three to four ounces of tobacco a week. On examination he was of a slight build. The blood-pressure was 120/75 mm. Hg. All pulses were palpable in the right leg. The left femoral pulse was weak and delayed compared with the right. No pulses distal to the femoral were felt in the left leg. There was drooping and wasting of the left buttock. The circumference of the left thigh was half an inch less than that of the right; the circumference of the calves was equal. No nutritional changes were seen in the nails or skin of the feet. There was muscle-tenderness of the left calf. Physical examination was otherwise negative.

Investigations

Tonoscillography after exercise. Prolonged disappearance of pulsations at the left ankle, calf, and thigh.

Radiography. Some calcification in the aortic arch.

Aortography (Plate 4, Fig. 2). Irregularity of the lumen of the aorta, and complete occlusion of the left common iliac artery at its origin; left internal and external iliac arteries filled through collaterals. Right iliac arteries normal.
Treatment. He was treated conservatively, and advised to stop smoking. Some months later he had increased his walking distance from 200 yards to three-quarters of a mile.

Case summary. A case of complete obstruction of the left common iliac artery at its origin, with irregularity (presumably atheromatous) of the aorta.

Case 4. Female, aged 64. Housewife

First seen in April 1950, with two years’ history of ‘heaviness’ of the legs on walking. One year after the onset she had cramp-like pain in the feet and calves on walking. Some months before her admission the pain became severe and continuous, and the toes and heels of both sides became discoloured. Carcinoma of the cervix uteri had been treated by radium in 1938. She smoked 10 cigarettes a day. Examination showed an obese woman, worn out by incessant pain. The blood-pressure was 150/65 mm. Hg. On the left side the femoral artery only was palpable, and no pulsation was felt in the arteries of the right leg. There was gangrene of the right fifth toe, the right heel, and the left great and second toes. On pelvic examination there was partial vaginal occlusion. Physical examination was otherwise negative.

Investigations

Radiography. Some calcification in the left iliac arteries and both femoral arteries.

Aortography (Plate 4, Fig. 3). Much narrowing of the last inch of the abdominal aorta, and complete occlusion of the right common iliac artery at its origin. Narrowing of the left common iliac artery. Right femoral artery filled through collaterals; left femoral artery obstructed just below the origin of the profunda femoris.

Treatment. Both legs were subsequently amputated at mid-thigh.

Case summary. A case of complete obstruction of the right common iliac artery and of the proximal part of the left femoral artery. Gross narrowing of the terminal aorta and left common iliac artery suggested that this was an early case of Leriche’s aortic bifurcation syndrome.

Case 5. Male, aged 50. Tyre-fitter

First seen in August 1950, with one year’s history of ischaemic pain on walking in the left calf and thigh. He also complained of ‘pins and needles’ in the left foot, especially after exercise. He smoked 30 cigarettes a day. Examination showed a heavily built man. The blood-pressure was 145/85 mm. Hg. All pulses were present in both legs, but were weaker on the left side. The left femoral pulse was much weaker than the right, and was delayed. There was wasting and drooping of the left buttock. The circumference of the left thigh was half an inch less than the right; that of the calves was equal. No nutritional changes were seen in the nails or skin of the feet. Physical examination was otherwise negative.

Investigations

Tonoscillography after exercise. Prolonged disappearance of pulsations at the left ankle, calf, and thigh.

Femoral arteriography. Normal left femoral, popliteal, and tibial vessels.

Treatment. He was treated conservatively, and advised to stop smoking. Six months later his symptoms were unchanged.
Case summary. Pain on exercise in the left calf and thigh, with weak and delayed left femoral pulse, abnormal tonoscillographic findings in the thigh after exercise, and a normal femoral arteriogram, were considered conclusive evidence of arterial obstruction above the groin.

Case 6. Male, aged 64. Farmer
First seen in March 1951, with five years' history of tiredness of the thighs, particularly the right, on bicycling. Two years after the onset he had ischaemic pain on walking in both calves and thighs, especially on the right. He smoked two ounces of tobacco and 20 cigarettes a week. On examination he was of normal build. The blood-pressure was 145/80 mm. Hg. Femoral pulses only were felt in both legs; the right femoral pulse was much weaker than the left. There was hypotonia of the right buttock. The right thigh and calf were half an inch greater in circumference than the left. There was muscle-tenderness of both calves and of the right thigh. The nutrition of the skin was good, but the toe-nails on both sides were thickened and deformed. Physical examination was otherwise negative.

Investigations
Tonoscillography after exercise. Prolonged disappearance of pulsations at right ankle, calf, and thigh.
Aortography. Abdominal aorta tortuous, its terminal part narrowed. Right common iliac artery completely obstructed at its origin. Left common and external iliac arteries normal. Left femoral artery obstructed just below the inguinal ligament.

Treatment. The patient was treated conservatively, and was observed for too short a time to assess progress.

Case summary. A case of complete occlusion of the right common iliac artery, with narrowing of the terminal aorta, and occlusion of the left femoral artery just below its origin.

Case 7. Male, aged 53. Painter and decorator
First seen in March 1951, with two and a half years' history of ischaemic pain on walking in the left foot and calf, and of indolent ulceration under the left fifth toe. There was pain when at rest in the left leg and foot, and intermittent 'pins and needles' in both feet. The left great toe had been lost through frost-bite in 1915. Bilateral lumbar ganglionectomy had been performed one year before we saw him. He smoked 20 cigarettes a day. On examination he was of normal build. The blood-pressure was 140/75 mm. Hg. Femoral pulses only were felt in both legs; the left femoral pulse was weaker than the right. There was wasting and hypotonia of the left buttock. The circumference of the left thigh was two inches less than that of the right, and that of the left calf one inch less than the right. There was a healed ulcer of the left fifth toe. The nutrition of the toe-nails was poor on both sides. Physical examination was otherwise negative.

Investigations
Tonoscillography after exercise. Insufficient pulsations to record at the left ankle and calf. Prolonged disappearance of pulsations at the left thigh.
Radiography. Calcification in the iliac, femoral, and tibial vessels on both sides.
Aortography. Aorta normal. Left common iliac artery grossly narrowed for
the first inch. Left external iliac artery completely occluded just above the
groin; left femoral artery filled through collaterals. Right iliac arteries normal.

Case summary. A case of partial occlusion of the left common iliac artery
with complete obstruction of the left external iliac artery. It was of interest to
notice that abnormal tonoscillographic findings after exercise were present in
spite of a preceding ganglionectomy. A similar sequence of events was found by
Ejrup (1948).

Case 8. Male, aged 52. Shoemaker

First seen in March 1950, with early gangrene of the left fifth toe. There was
a three years' history of ischaemic pain on walking in both feet, calves, and
thighs. Latterly he could only walk 20 yards. He had severe pain when at rest
in the left foot and left fifth toe. He smoked at least 20 cigarettes a day. On
examination he was of slight build. The blood-pressure was 180/90 mm. Hg.
Retinoscopy showed arterial narrowing, and a few small hard patches of exudate.
No pulsation was felt in the abdominal aorta, femoral arteries, or the more
distal vessels of the legs. There were nutritional changes of the nails in both
feet, and a patch of gangrene on the left fifth toe.

Investigations

Tonoscillography after exercise. Pulsations were insufficient to record on
either side.

Radiography. Calcification in the iliac, femoral, and tibial vessels.

Aortography. No filling of the aortic bifurcation or iliac vessels. Radiographs
were not taken high enough to show the actual block, but the inferior mesenteric
vessels filled, a fact which was strong presumptive evidence of complete aortic
obstruction below that level.

Treatment. This was conservative, with rest in bed, toilet of the gangrenous
area, and passive leg-exercises. 25 to 50 mg. of tolazoline at 9 p.m. relieved
night pain. The left fifth toe finally healed. He was much improved on dis­
charge, and seven months later he could walk 150 yards and had no pain at
night.

Case summary. A case of obstruction of the lower end of the abdominal aorta.

Group 2. Cases in which the diagnosis rested on clinical and tonoscillographic
evidence (Cases 9 to 11).

Case 9. Male, aged 60. Clerk

First seen in August 1950, with three years' history of ischaemic pain on
walking in both calves, spreading into the left thigh. He smoked 30 cigar­
ettes a day. On examination he was of slight build. The blood-pressure was
155/95 mm. Hg. The femoral arteries only were palpable on both sides; the
left femoral pulse was weak and delayed compared with the right. There was
weakness and hypotonia of the left buttock. The left thigh was half an inch less
in circumference than the right. The circumference of the calves was equal.
Muscle-tenderness was present in the left thigh and in both calves. There was
thickening and distortion of the toe-nails on both sides. Physical examination
was otherwise negative.

Investigations

Tonoscillography after exercise. Insufficient pulsations to record at the left
ankle; prolonged disappearance of pulsations at the left calf and thigh.
Radiography. Calcification of the iliac, femoral, and tibial vessels on both sides.

Treatment was conservative. Six months later there was no change in symptoms.

Case summary. Pain on exercise in the left calf and thigh, a weak and delayed left femoral pulse, and abnormal tonoscillographic findings in the left thigh after exercise strongly suggested iliac obstruction. Symptoms were also present on the right side, and clinical and tonoscillographic findings suggested femoral obstruction.

Case 10. Male, aged 62. Clerk

First seen in March 1950, with 10 years' history of ischaemic pain on walking in the right calf and thigh. Initially pain was also present on the left side, but this disappeared in 1946. His father also had suffered from intermittent claudication. He smoked 30 cigarettes a day. Examination showed a man of normal build. The blood-pressure was 160/90 mm. Hg. The right femoral pulse was felt, but was weak and delayed compared with the left. No other pulses were felt on the right side. On the left side all pulses were felt except the popliteal. The circumference of the thighs was equal, but the circumference of the right calf was half an inch less than that of the left. There was no wasting or hypotonia of the buttocks. No nutritional changes were seen in the toe-nails or skin of the feet. There was muscle-tenderness of the right thigh and calf. Physical examination was otherwise negative.

Investigations

Tonoscillography after exercise. Prolonged disappearance of pulsations at the right ankle, calf, and thigh.

Radiography. Calcification in the iliac, femoral, and tibial arteries on both sides.

Femoral arteriography. Complete obstruction of the middle third of the right femoral artery; irregularity of the lumen of the popliteal and tibial arteries.

Treatment was conservative. One year later the condition was unchanged.

Case summary. This patient was shown to have right femoral obstruction, but the occurrence of pain in the thigh, the weak and delayed right femoral pulse, and the abnormal tonoscillographic findings in the right thigh after exercise strongly suggested iliac obstruction in addition.

Case 11. Male, aged 75. Retired

First seen in April 1951, with four years' history of ischaemic pain on walking in the right calf and thigh. He smoked 15 cigarettes a day, as well as a pipe. On examination he was of normal build. The blood-pressure was 240/90 mm. Hg. The right femoral pulse was weak and delayed compared with the left, and no pulses could be felt distal to it. On the left side only femoral and posterior tibial pulses were felt. The circumference of the right thigh was one inch less than that of the left. There was muscle-tenderness of the right calf. No nutritional changes were seen in the toe-nails or skin of the feet. Physical examination was otherwise negative.

Investigations

Tonoscillography after exercise. Insufficient pulsations to record at the right ankle and calf; prolonged disappearance of pulsations at the right thigh.
OBLITERATIVE DISEASE OF THE ABDOMINAL AORTA

Radiography. Calcification of both iliac arteries and in the right femoral and tibial arteries.

Treatment was conservative; his further progress is unknown.

Case summary. The occurrence of pain in the thigh, the weak and delayed right femoral pulse, and the abnormal tonoscillographic findings in the right thigh after exercise strongly suggested iliac arterial obstruction.

Summary

1. Ten cases of occlusion of an iliac artery and one case of occlusion of the abdominal aorta are reported.
2. Eight of these cases occurred in 53 consecutive cases of intermittent claudication due to obliterative arterial disease.
3. The main clinical features were intermittent claudication with pain extending into the thigh, an absent, weak, or delayed femoral pulse, wasting of the affected thigh, and wasting or hypotonia of the buttock.
4. The diagnosis may be confirmed by finding prolonged disappearance of pulsations in the thigh on tonoscillography after exercise, or directly by aortography.

REFERENCES

Ejrup, B. (1948) Acta med. scand. 130, Suppl. 211.
Leriche, R. (1940) Presse méd. 48, 601.
Fig. 2. Aortogram (Case 3) showing a tortuous aorta and complete obstruction of left common iliac artery at its origin. The left external iliac artery may be seen filled through collaterals.

Fig. 3. Aortogram (Case 4) showing narrowing of the terminal aorta, complete obstruction of right common iliac artery at its origin, and irregular narrowing of left common iliac artery. The lumbar arteries on the right side are dilated.