AORTO-ILIAC OCCLUSIVE DISEASE*

A REPORT ON 67 CONSECUTIVE CASES TREATED SURGICALLY

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(*Continued from page 375 of the* Journal *for 6 May, 1961*)

TREATMENT

We do not propose discussing treatment in detail, but wish to mention the types of operation performed and the results obtained. We cannot emphasize too strongly that surgical treatment is only part of the overall management of these patients, who require life-long observation and careful supervision. In all of them careful instructions must be given in regard to abstinence from smoking, foot care, low-lipid diet and graduated exercises. Those with involvement of the distal vessels may have to continue with Buerger's exercises and the general cardiovascular state may require special attention. It is our practice to commence anticoagulant therapy 24 - 27 hours after operation and to continue with it indefinitely unless there are contra-indications. We do not prescribe antispasmodics in patients with occlusive vascular disease.

OPERATIONS

The types of operation performed included thrombo-endarterectomy (56), thrombo-endarterectomy combined with excision and grafting (6), bypass grafting (3), and sympathectomy (2) — see Table VII.

TABLE VII. TYPE OF OPERATION PERFORMED IN RELATION TO NATURE OF LESION

	A	*AI*	*I*	*IF*	*AIF*	*Total*
Number of cases	7	15	6	6	33	67
Endarterectomy	6	13	6	5	26	56
Endarterectomy and graft	—	2	—	—	4	6
Graft	1	—	—	1	1	3
Sympathectomy	—	—	—	—	2	2

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

Our bias has been towards thrombo-endarterectomy, and simple bypass grafting was rarely performed. The latter procedure was carried out in our first case with a localized aortic bifurcation block and in 2 patients who had additional involvement of the superficial femoral artery. In 1 of these 2 patients the graft was taken from the common iliac to the popliteal with side-to-side anastomosis to the common femoral. All the grafts were of woven, crimped 'teflon'.

In 6 patients thrombo-endarterectomy of the proximal vessels was combined with distal ilio-femoral or ilio-femoro-popliteal grafting. In 5 of them this was necessary because of damage to the iliac vessels by the stripper, and in 1 the graft was used to bypass an occluded superficial femoral artery.

'Extended lumbar sympathectomy' with removal of the ganglia from T9 to L3 inclusive was done in 2 patients. Both had extensive disease with calcification and were considered technically unsuitable for direct arterial surgery.

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RESULTS

Early Results (Table VIII)

The results were classified as excellent or improved only when there was both objective and subjective clinical improvement as well as a significant improvement in oscillometry (Fig. 21) and/or plethysmography (Fig. 22).

TABLE VIII. RESULTS OF SURGERY—EARLY

	A	*AI*	*I*	*IF*	*AIF*		*Total*
Number of cases	7	15	6	6	33	67	
Local:							
Excellent	6	8	5	2	11	32	56 (83%)
Improved	1	7	1	2	13	24	
Unchanged	—	—	—	1	4	5	
Unchanged but amputation	—	—	—	1	2	3	11
Worse	—	—	—	—	1	1	
Worse and amputation	—	—	—	—	2*	2	
Pulses:							
Returned	4	6	3	4	5	22	
Improved	2	5	1	—	5	13	45 (67%)
Unchanged (present)	1	4	2	1	2	10	
Unchanged (absent)	—	—	—	1	19	20	
Disappeared	—	—	—	—	2	2	

* One of these patients died subsequently.
A, AI, I, IF, AIF as in Table III.

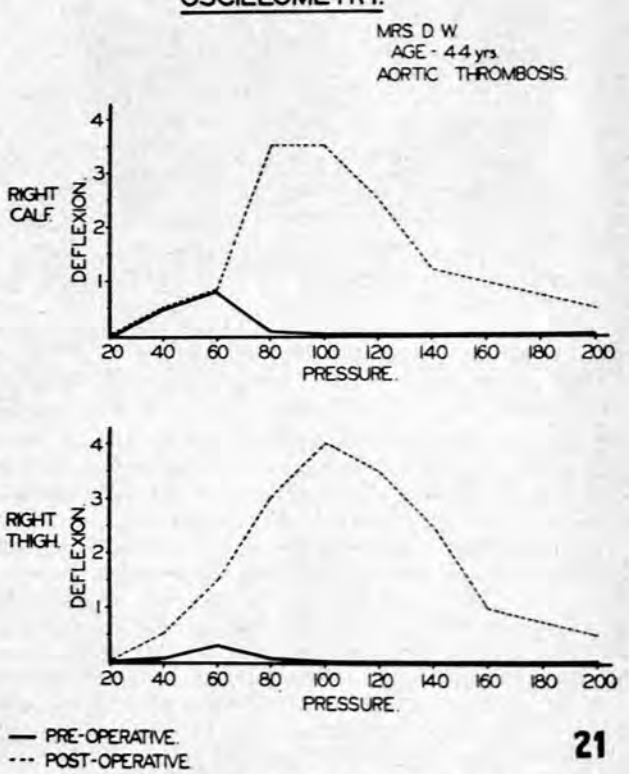

Fig. 21. Oscillometry showing a marked improvement in pulsation in right calf and thigh following the removal of an occlusion at the aortic bifurcation.

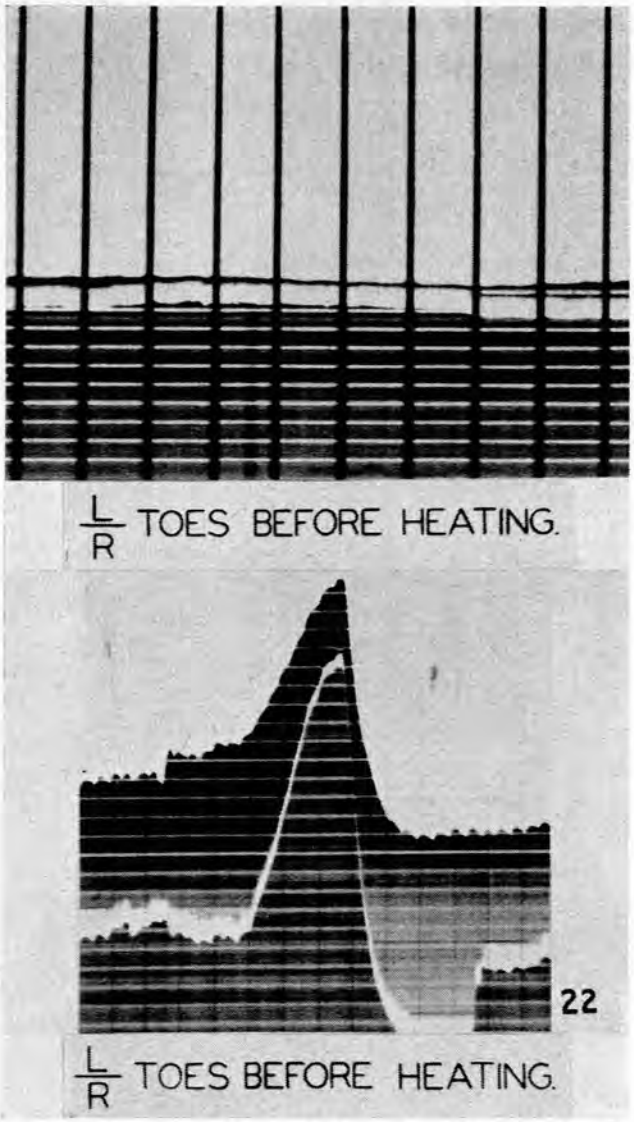

Fig. 22. Plethysmography demonstrating significant improvement following aorto-iliac endarterectomy. Note: Upper graph — before operation; lower graph — after operation.

On this basis the results in 56 (83%) of the patients were regarded as successful. It should be noted that successful results were obtained in every one of the patients with localized aortic, aorto-iliac or iliac blocks.

Postoperatively, pedal pulses were palpable in 45 patients but were classified as 'returned' or 'improved' in 35 only. This is not surprising because the femoral vessels were involved in 39 (60%) of our patients. Indeed, pedal pulses could be felt in all of the 28 patients who had localized blocks, although they were regarded as 'returned' or 'improved' in 21 only.

The results were unsuccessful in 11 patients and all of them had associated femoral occlusions. In 8 the condition of the limb remained unchanged; 3 of them required amputations 1 - 6 weeks later, but this would have been necessary anyway. In 3 patients surgery aggravated the ischaemia. One of them required amputation after a week and another developed extreme ischaemia of both limbs necessitating amputation of 1 limb after 8 days. This patient died 20 days after the original operation.

Late Results (Table IX)

Our patients have not been followed-up for a sufficiently long period to justify any claims in regard to success. Nevertheless, there are some points of interest.

The follow-up period ranged from 4 to 22 months with an average of 7½ months. In 31 the period was less

TABLE IX. RESULTS OF SURGERY—LATE

Number of patients	*A* 7	*AI* 15	*I* 6	*IF* 6	*AIF* 33	*Total* 67
Early successes:	7	15	6	4	24	56
Relapse	—	4	—	—	5	9
Re-operation	—	2	—	—	3	5
Late result:						
Success	7	12	6	3	23	51
Deteriorating	—	2	—	—	1	3
Amputation	—	—	—	1	—	1
Death	—	1	—	—	—	1
Early failures:	—	—	—	2	9	11
Early death	—	—	—	—	1	1
Re-operation	—	—	—	—	4	4
Late result:						
Success	—	—	—	—	2	2
Unchanged	—	—	—	1	4	5
Deteriorated	—	—	—	—	2	2
Death	—	—	—	1	—	1

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

than 6 months; in 20 from 6 to 12 months; and in 15 from 12 to 24 months.

Second operations were done in 9 patients — in 5 for a relapse after initial success and in 4 for progressive deterioration after initial failure. Two had localized aorto-iliac occlusions and 7 had extensive aorto-ilio-femoral disease. One of the patients died of renal failure and 2 were not improved, but the remaining 6 are much improved and symptom-free.

Of the 56 patients in whom early successes were obtained, the subsequent progress was as follows:

1. Forty-seven remained symptom-free with good circulation in both limbs.

2. Five had major relapses due to re-thrombosis of the iliac vessels. Two of these had localized aorto-iliac occlusions and 3 had diffuse aorto-ilio-femoral disease. All were operated upon for a second time with success in 4. There was 1 postoperative death due to a renal 'shut-down'.

3. Three have gradually deteriorated with disappearance of pulses which had been present. Two of them had localized aorto-iliac thrombosis and one had aorto-ilio-femoral occlusion.

4. One developed a secondary haemorrhage from the femoral anastomosis of an ilio-femoro-popliteal bypass graft for ilio-femoral occlusion 2 months after the operation and required an amputation 1 month later.

Thus, of the original 56 successes, 51 are now symptom-free, 3 have deteriorated, one has required an amputation and one has died after a re-operation.

Of the 11 patients in whom the early results were unsuccessful, 1 died early and the subsequent progress in the remaining 10 was as follows:

1. Four were re-operated upon because of progressive deterioration. All of them had aorto-ilio-femoral occlu-

sions. Two improved after re-operation but the other 2 continued to deteriorate.

2. One who had had an early amputation for ilio-femoral occlusion, died of a coronary thrombosis 2 months later.

3. Five have remained unchanged. Three of these had had amputations for aorto-ilio-femoral occlusions. One had diffuse aorto-ilio-femoral disease treated by sympathectomy and 1 had ilio-femoral occlusion.

Thus of the 10 early failures who have been followed-up, 2 have been improved, 5 are still unchanged, 2 have deteriorated despite re-operation and 1 has died of coronary thrombosis.

Overall Results (Table X)

The overall results, summarized in Table X, show that our initial success rate was 83% and the later success rate 79%. The initial mortality was 1·5%, but since then it has increased to 4·5%. Early amputations were required in 6% and this figure has increased to 7·5%. No doubt a longer follow-up will reveal even more late failures although many of them may still benefit from second or even third operations. However, the first 15 patients in this series have now been followed up for more than a year and the results are still successful in 12 (80%). The 3 failures all had diffuse aorto-ilio-femoral disease. One of them required an early amputation and the initial results in the other 2 were also unsuccessful. Our results, therefore, compare favourably with those of others.[10,15,23,25,26] In general, the success rate of operations on aorto-iliac occlusions after 18 - 24 months appears to be 70 - 80% and the initial mortality 2 - 5%.

TABLE X. RESULTS OF SURGERY—SUMMARY

	Without femoral involvement	*With femoral involvement*	*Total*
Number of patients	28	39	67
Early results:			
Successful	28 (100%)	28 (72%)	56 (83%)
Amputation	—	4	4
Death	—	1	1
Late results:			
Successful	25 (89%)	28 (72%)	53 (79%)
Amputation	—	1	1
Death	1	1	2
Total amputations	—	5	5
Total deaths	1	2	3

It should be noted that, in patients with localized segmental occlusions (aortic, iliac or aorto-iliac), the initial success rate was 100% with no mortality and the later success rate 89% with 1 (3·6%) death and no amputations. These figures approximate the phenomenal successes claimed by Crawford *et al.*[10] and contrast strikingly with the results in patients suffering from diffuse occlusions. Femoral occlusion is probably the most important single factor to lower the success rate. Firstly, it compromises an adequate 'run off' and so predisposes to early thrombosis. Secondly, about 50% of the grafts will close later.[25,26]

Extensive disease of the external iliac has also been an adverse factor, in our experience, mainly because it is usually accompanied by femoral occlusion. Thus in 6 patients with ilio-femoral occlusions initial successes were obtained in 4, while 1 remained unchanged and 1 required an amputation. Later, the amputee died and 1 of the early successes relapsed and required an amputation. In the same way extensive involvement of the external iliac in patients with diffuse aorto-ilio-femoral occlusions compromised the results.

Distal-vessel thrombosis undoubtedly affected the result adversely, but was not always easy to detect either clinically or radiographically. However, in general the patients who had foot claudication, severe rest pain and major ischaemic lesions, did not do as well as the others.

DISCUSSION

From the above it should be clear that patients with localized segmental blocks are more suitable for direct arterial surgery than those with diffuse disease. Not only are the results of surgery considerably better in the group with localized disease, but the incidence of associated cardiovascular disease and hypertension is less; consequently they are more favourable surgical risks.

The vital question, however, is whether surgery is indicated or indeed justified for segmental occlusions. It must be remembered that, until medical or dietary measures can control the inevitable progression of atherosclerosis, this type of surgery is no more than palliative.[12] Many patients, treated conservatively, continue to lead useful lives for long periods with no more than mild, non-progressive symptoms.[12,27,29] De Wolfe *et al.*[11] followed 24 patients on conservative treatment for periods of 1 - 5 years and 11 improved, 10 remained unchanged and only 3 became worse. Singer and Rob[27] found that, of 22 patients treated conservatively over a period of 36 months, 20 were improved or remained unchanged. The long histories in many of our cases support this observation and so do Michael Boyd's[5] figures for the risk of amputation. In 1,440 patients who presented with claudication Boyd[6] found that the chance of amputation was 7·2% in the first 5 years and 12·2% in the first 10 years. He also found that none of those who had died succumbed from the effects of the local arterial lesion. Ill-advised surgery, which may end in the premature loss of a single life or even a single limb would, therefore, indeed be a tragedy.

On the other hand, there are some arguments in favour of early surgery. In the first place, many of the patients are comparatively young, and the restricted activity imposed upon them by this claudication may seriously affect their livelihood. Even Michael Boyd,[5] that great advocate of lumbar sympathectomy, admits that sympathectomy is of real value only in early grade 2 claudication. That would exclude 53 (78%) and probably 64 (95%) of the patients in our series and all those with localized blocks. Many of them found that their claudication was interfering with their work and direct arterial surgery was thus deemed justifiable.

In the second place there is the chance of further thrombosis. Although it is true that these patients do not progress rapidly from segmental to diffuse obstruction, which may be beyond the help of surgery,[12] Boyd[6] has found that the risk of further thrombosis is 20·9% in the first 5 years and 36·4% in the first 10 years; this will undoubtedly lessen the chances of successful surgery. Therefore, if there are any signs of progress, removal of a segmental occlusion seems fully justified.

Thirdly, there is the risk, only recently recognized and still unknown, of renal involvement with the development

of malignant hypertension. Our study of this aspect has been incomplete, but Starer and Sutton,[28] in a study of 32 consecutive cases of aortic thrombosis examined by aortogram, found the renal artery to be involved in 2. Fourthly, there is another unknown risk, namely, that of peripheral embolization from the aorto-iliac clot. These risks may yet prove to be sufficiently significant to justify early surgery, but at present we agree with Singer and Rob[27] that 'in many patients intermittent claudication is a relatively benign condition and that with proper selection, only a proportion of patients will require active surgery'.

In patients with diffuse aorto-iliac disease, particularly if associated with femoral involvement, the problem is different. Not only may we expect poorer results, but there is a significant incidence of associated coronary heart disease and hypertension. The risks of direct arterial surgery are, therefore, considerable, and many of the survivors are likely to succumb from cardiac, cerebral or interrecurrent disease within 5 - 10 years following operation. Michael Boyd[5] found that the chance of survival for 5 years was 73%, but that this chance was almost halved for 10 years (38·8%). 'Few of us would put a new engine into a car whose body was unlikely to see the year out; and likewise we should perhaps hesitate before undertaking grafting operations.'[2] Relieving the patient of his claudication is useless if his angina will not allow him to walk much further[6] or if his arthritis and emphysema keep him at home.

On the other hand, once secondary femoral thrombosis has developed, the ischaemia is very likely to progress to gangrene,[6] the claudication distance diminishes progressively to the point where the patient can hardly move and persistent rest pain interferes with his sleep. These are all ominous signs and, unless relieved by timely surgery before the popliteal and distal vessels have thrombosed, there is a grave risk that the patient will lose one or more limbs or simply fade away because of all the misery.[27] There can be no question that surgery is justified in these cases but the real problem is what type of surgery should be undertaken.

In Table XI our unsuccessful results in relation to the type of operative procedure are analysed. Comparisons

TABLE XI. UNSUCCESSFUL RESULTS IN RELATION TO TYPE OF OPERATION PERFORMED

	Endarterectomy	*Endarterectomy and graft*	*Graft*	*Sympathectomy*	*Total*
Number of patients	56	6	3	2	67
Early failures:					
Deaths	—	1	—	—	1
Amputations	3	1	—	—	4
Others	1	2	2	1	6
Subtotal	4	4	2	1	11
Later failures:					
Closure — successful re-operation	4	—	—	—	4
Closure—death	1	—	—	—	1
Haemorrhage — amputation	—	—	1	—	1
Relapse — distal closure	2	—	—	1	3
Subtotal	7	—	1	1	9

are not valid because of the small numbers treated by grafting and sympathectomy. Nevertheless, there are some observations which may be of interest.

1. *Endarterectomy* was attempted in 62 of the patients. It was technically possible to disobliterate the vessels in 56, with success in 52 (91%) and no early deaths. In 4 the vessels re-thrombosed early. Three of these patients lost their limbs — 2 in spite of surgery and 1 because of surgery. All the failures had diffuse disease with femoral involvement and a poor 'run off'.

In 5 patients the vessels re-thrombosed at a later date — all within 6 months. Two had localized aorto-iliac occlusions and 3 diffuse aorto-ilio-femoral occlusions. Two others with aorto-iliac occlusions developed later distal-vessel thrombosis.

The initial success rate was 91%, the late success rate 80%, and the overall surgical mortality 1·8%. This compares favourably with the results of others whose figures are 60 - 70% (initial successes), 60 - 70% (late successes), and 2 - 3% (mortality).[5] It should be noted that 7 of the 11 patients had femoral involvement with a poor 'run off'. It might therefore be argued that the results would have been improved by simultaneous femoral endarterectomy or bypass. This will be discussed below.

2. In 6 patients endarterectomy had to be supplemented by *grafting*. All these patients had diffuse disease with involvement of the external iliac and femoral vessels. In 5 our attempts at complete disobliteration damaged the vessels, which had to be replaced by grafts. In the sixth, endarterectomy was combined with an ilio-femoro-popliteal graft to bypass an occluded superficial femoral artery.

There were 4 early failures. One patient lost his life and another a limb because of surgery. There have been no later failures as yet, but these few cases seem to indicate that grafting after failed endarterectomy will not succeed. We have found that extensive endarterectomy from aorta to femorals and beyond is often extremely difficult, especially when the external iliac and femoral vessels are involved. This experience has convinced us that endarterectomy should rather not be attempted in these circumstances because failure carries the grave risk of loss of a limb or even of the patient's life. We certainly do not recommend extensive endarterectomy from aorta to popliteal for diffuse aorto-ilio-femoral occlusions. We also feel that endarterectomy of the external iliac should at all times be approached with caution and that it should be abandoned if any difficulty is encountered, lest the vessel be damaged and patent collaterals sacrificed. A method of treating diffuse disease that suggests itself is endarterectomy of aorta and common iliacs combined with ilio-femoro-popliteal or femoro-popliteal bypass grafting. Our experience of grafting after failed endarterectomy, however, makes us hesitate to follow this procedure and it would appear to be wiser to rely on primary bypass grafting or even sympathectomy.

3. Only 3 primary *bypass grafts* were done. All failed because of inadequate 'run off'. However, the ischaemia was not aggravated in any of the patients. We have been very satisfied with femoro-popliteal bypass grafts for femoral occlusions. Others claim excellent results for bypass grafting in aorto-iliac disease, the average figures being: mortality, 2 - 5%; initial success, 95%, and late success, 80%.[5] It would appear, therefore, that the insertion of grafts merits a trial particularly in diffuse disease when endarterectomy is not feasible. Unfortunately the initial success rate of bypass grafting is not maintained and may fall to 50%, due largely to the progress of the disease which interferes with the 'run off'.[25,26] Nevertheless, the operation has the great advantage that, if it fails, the

patient is none the worse; also the graft can be taken from the aorta to the popliteal artery if necessary. A most important factor for successful grafting, however, is a free distal outflow, and grafting, therefore, should not be done if the distal vessels are unsatisfactory. It should be noted that an adequate 'inflow' is as important as the outflow, and therefore simple femoro-popliteal grafting will not suffice in patients who have proximal disease as well as femoral occlusion.

4. *Lumbar sympathectomy* was done in 2 patients only, but in the past we have treated many patients by this method. One patient improved temporarily and the other remained unchanged. This is in keeping with our general experience with this method of treating diffuse atherosclerosis. However, we have recently done extended lumbo-dorsal sympathectomies (T9 - L3) with more promising results. This may yet prove to be the operation of choice in poor-risk patients and in those with extensive occlusive disease who are unsuitable for bypass grafting because of occluded distal vessels. We are now using it more frequently because 'there is a great deal to be said for being content to allow these patients to grow old gracefully'.[5] In certain patients the use of sympathectomy in addition to direct arterial surgery may improve the likelihood of continued function of the re-established circulation.[16]

In summary, therefore, we tentatively recommend the following:

1. Localized aortic, common iliac or aorto-iliac occlusions — thrombo-endarterectomy (only if the symptoms are incapacitating).

2. Localized external iliac occlusions — attempt endarterectomy but abandon if any difficulty occurs, and insert an ilio-femoral bypass graft (preferably from the end of the common iliac).

3. Ilio-femoral occlusions — bypass graft from aorta or common iliac to the popliteal with side-to-side anastomosis to the common femoral, provided the 'run off' at the popliteal is adequate. If the 'run off' is poor, perform lumbar sympathectomy.

4. Aorto-ilio-femoral occlusions —

(*a*) If the proximal disease is mainly in the aorta and common iliacs with a good backflow into the distal common iliac, and the popliteal 'run off' is good, combine proximal endarterectomy with simultaneous or later femoro-popliteal grafting or endarterectomy.

(*b*) If the proximal disease is more diffuse with external iliac involvement but the popliteal 'run off' is still good, insert an aorto-femoro-popliteal graft.

(*c*) If the patient is a poor surgical risk, or the disease is extremely diffuse with calcification, or the popliteal 'run off' is poor, perform bilateral 'extended' lumbar sympathectomy.

CONCLUSION

In recent years the scope of and indications for direct arterial surgery have continued to widen. Some surgeons are even bypassing and disobliterating normal arteries; this, no doubt, improves their overall results! Others regard vascular surgery as 'an initiation test to surgical manhood'[2] and dabble in disobliterating or joining arteries even before they have mastered the art of stripping veins or of intestinal anastomosis. Caution is obviously called for in the selection not only of patients but also of the surgeon.

In introducing this subject we made a plea that arterial thrombosis should always be considered in the differential diagnosis of every case of 'lumbago and sciatica'. In conclusion, our request is not to over-react by rushing into a diagnosis of vascular insufficiency without careful appraisal for, beware, 'the winds of change are blowing' and 'blocked arteries' rather than 'slipped discs' may become the vogue among backache sufferers. The onset of arteriosclerosis nearly always marks the beginning of a generalized degeneration in all tissues. Joint cartilages are wearing thin; spinal discs are degenerating; muscles are wasting and fibrositic conditions are widespread.[5] When these painful and disabling afflictions involve the lower back and limbs, a considerable problem is presented to both patient and doctor.

Before embarking on formidable surgical procedures, let us pay heed to the warning given by Lord Cohen of Birkenhead[9] who said: 'Backache is a symptom, not a disease, even when labelled 'lumbago' . . . It is a graveyard in which are buried once-fashionable methods of treatment which were founded on speculative pathology; the ghosts of these are restless and one must beware of their reappearance even when clothed in different garb'.

SUMMARY

The clinical features of 67 consecutive cases of aorto-iliac occlusive disease are described. Particular emphasis is laid on the many pitfalls which may be encountered in diagnosis, both clinically and by special investigation. The methods of treatment used in these cases are outlined and the results are analysed.

Indications for surgery in the localized and diffuse types of disease are discussed in relation to the results, and a scheme is presented outlining the type of operation recommended under particular circumstances.

The extreme care required for accurate diagnosis of aorto-iliac occlusive disease and for selection of patients for surgery is again emphasized.

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