indecently exposing himself, the evidence is overwhelming that it is not the circumstances which are unusual but the man. We might then very properly apply the Scandinavian system of trying to say what is the best way of handling the man, and abandon methods of treating him which would be appropriate only to the average case.

What is so obviously true of the recidivist criminal may also be very often true of the single very abnormal crime. Murder, in the statistical sense, is highly abnormal; in England and Wales there are only about 150 murders a year. Murder is also in a majority of cases the act of a man who is mentally ill. In this country, over the course of fifty years, in 22% of murders known to the police the suspect committed suicide. Of murderers brought to trial at Assizes, 14% were found unfit to plead. Of those found guilty of the act charged 39% were found guilty but insane. Of those sentenced to death 4% were respited to Broadmoor, and a further 42% had their sentences commuted to penal servitude, in a proportion of cases on psychiatric grounds. It is then hardly surprising that no one has been able to produce any convincing evidence that capital punishment acts as a deterrent for such a pathological event.

Conclusion

At the present stage in the development of criminal law, we are half-way between the irreconcilable aims of fitting the punishment to the crime and fitting the punishment to the criminal. It would not seem possible to abandon either aim entirely and replace it by the other. But it should not be beyond the reach of inquiry to find the principles of classification which would provide the basis of a just and efficient penology, to find the means of distinguishing the crimes in which the element of personal deviation is large from those in which it is small, to classify the kinds of deviation and measure their degree, and to work out the means of treatment of the causes, both in individuals and in societies, which lead to crime.

TREATMENT OF PERIPHERAL VASCULAR DISEASE IN OLD AGE*

BY

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With increasing age the incidence of atherosclerosis rises, and more old people die from the resultant occlusion of an important blood vessel than from any other cause. Information about the incidence of a significant degree of atherosclerosis is difficult to obtain, but when the peripheral arteries of the legs are involved a definite symptom, intermittent claudication, may arise and can be recorded. Gavey (1949) found that this symptom was present in 1.1% of 360 persons over the age of 70. Droller and Pemberton (1953) encountered it in approximately 6% of "elderly" people, although it was disabling in only 1.5%. Since, however, this complaint will usually arise only in those able to walk far or fast, it is probable that an even larger number of old people have a diminished blood supply to the lower limbs. In many who are admitted to hospital for other reasons, examination will reveal cold feet, nutritional changes, or absent pulses at the ankle. Some may present with gangrene. Old people, moreover, take less exercise, are often confined to bed, and may suffer from bouts of congestive heart failure. They are thus

especially liable to develop venous thrombosis. The prevention and amelioration of these consequences of peripheral vascular disease in the elderly are clearly important problems.

Aetiology of Atherosclerosis

This vast and controversial subject is discussed only so far as it is relevant to the possible prevention or improvement of the pathological state which underlies peripheral arterial disease. The condition known as senile medial calcification (Mönckeberg's sclerosis) is of little interest in this connexion, as it leads to rigidity but not to narrowing of the arteries affected. Atherosclerosis is found with unexpected frequency in conditions associated with hypercholesterolaemia; such as diabetes, myxoedema, nephrosis, and essential familial hypercholesterolaemia. Gofman (1951) has shown that the serum cholesterol is bound to protein and that the lipoprotein molecules vary in size. By using the ultracentrifuge, he has been able to demonstrate that patients with diseases predisposing to atherosclerosis and those who have suffered a coronary thrombosis have present in their blood serum a relatively unstable lipoprotein molecule. Its relative concentration can be reduced by dietary restriction of cholesterol and fats.

Isotope studies have shown that some of the cholesterol present in the blood is derived from the acetate residues which result from normal fat, carbohydrate, and protein metabolism. It seems likely, therefore, that it is not only the cholesterol content of foodstuffs which is important but also the total calorie intake. There is strong supporting evidence that a high dietary intake of fat is linked with atherosclerosis, and there is some evidence that lipaemia is a factor in the causation of thrombosis. Duguid (1954) has, however, shed doubt on the association of the most important consequence of atherosclerosis—namely, arterial narrowing with a high cholesterol intake. Once symptoms due to atherosclerosis have developed it is in any case probably too late to advise dietary restriction, but it would nevertheless seem wise to recommend a low-fat diet to the elderly and the obese.

Kountz (1951) has claimed that advanced atherosclerosis is frequently associated with evidence of *hypothyroidism* and that the administration of thyroid extract is accompanied by a decrease in the incidence of the manifestations of atherosclerosis. There is little evidence to support this view, but it is probably true that mild hypothyroidism in the elderly is easily overlooked and may be a predisposing factor in arterial degeneration.

It is of the greatest importance to detect *diabetes mellitus*. The symptoms of this disorder in the elderly are often unimpressive, and patients may be seen for the first time with a gangrenous extremity. The disease is known to increase the rate of progress of atherosclerosis at all ages and it probably also gives rise to specific vascular changes which Lundbæk (1954) has termed "diabetic angiopathy." A high proportion of elderly diabetics suffer from occlusive vascular disease of the lower extremities. Lundbæk detected its presence in 50% of diabetics over the age of 60 and Semple (1953) in 42% of 100 diabetics with a mean age of 63. Of 52 consecutive cases of gangrene admitted to medical and surgical units, about half suffered from diabetes mellitus. Since the typical lesion is in the smaller vessels, gangrene in these patients can usually be treated conservatively and high amputation is rarely justified.

Clinical Features of Obstructive Arterial Disease in the Elderly.—The symptoms and signs of a diminished blood supply to the lower limbs are essentially the same at all ages. Their relative frequency, however, differs. Thus a young vigorous patient suffering from thromboangiitis obliterans is far more likely to complain of intermittent claudication than an old man whose capacity for exercise is limited by osteoarthritis or angina of effort. These patients are often admitted to hospital with the signs of thrombosis in a main artery or with small necrotic patches on the toes or heels. Usually they give a long history of persistently

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cold feet. If old people are questioned on this specific point and the legs are examined, a comparatively large number will be found to have other signs of diminished blood supply. A further group have symptoms of "erythralgia"; they complain of burning pain in the feet which is worse when the feet are warm or dependent, and some are kept awake by "pins and needles" or by painful cramps.

Treatment

Treatment of the established condition of senile obstructive arterial disease is directed towards (1) the prevention of skin lesions and of gangrene by the avoidance of trauma, (2) the improvement of the blood supply to the tissues, (3) the relief of symptoms, and (4) the management of established gangrene.

Prophylactic Measures

Patients should be told that they must treat their feet as if they were valuable pieces of porcelain. It is better to give a leaflet with written instructions and to go through its contents with either the patient or a relative or preferably both. Instructions such as the following should be included:

Care of the Feet

1. Treat your feet with the utmost care. Avoid crowds.
2. Wash the feet daily with soap and warm water, dry well and rub in toilet lanolin. Apply talc powder between the toes.
3. Keep the feet as warm as possible but do not apply direct heat. Do not sit too close to the fire. Use warmed bed socks in bed but do not use a hot-water bottle below the thighs.
4. Wear warm clothing in winter and warm woollen socks.
5. Wear well-fitting shoes of soft leather with leather soles and do not wear new shoes for too long at a time.
6. Do not wear tight garters or sit with your legs crossed.
7. Cut the toe nails only after washing the feet. Cut them straight across.
8. Do not cut corns or use corn cures. Do not put strong antiseptics such as iodine on your feet.
9. Go to your doctor at the first sign of a blister, an infection, ingrowing toe-nails, or trouble with bunions or corns.
10. Preferably stop smoking altogether. If you cannot, smoke as little as possible.
11. Do the following exercise. Put a chair on the bed upside down so that its back can be used to support your legs, and put a pillow on it. Lie on the bed with your feet raised on the chair for two minutes. Lower the legs and lie flat on the bed for three minutes. Repeat four times. Do these exercises four times a day in a warmed room.

Attempts to Improve the Blood Supply to the Tissues

The blood supply to muscles is largely independent of nervous control and is determined chiefly by the local release of metabolites. The supply to the skin, on the other hand, is regulated chiefly by the sympathetic nervous system. It is therefore easier to devise methods of improving relative ischaemia of the skin than of the muscles.

The results of attempts to improve *intermittent claudication* are most disappointing. Hamilton and Wilson (1952) investigated the results of eleven different types of treatment over a prolonged period, as well as the effects of single administration of seven different drugs. The vast majority of 40 patients failed to show any improvement as the result of treatment. These observers point out the great difficulty which exists in assessing the results of treatment, as considerable fluctuations in exercise tolerance occur spontaneously. Fig. 1 shows an example of spontaneous improvement while a patient was receiving inert tablets. The increased exercise tolerance in such cases may be either psychogenic or, more probably, the result of the progressive improvement which sometimes follows an arterial obstruction while a collateral circulation is developing. Fig. 2 shows the difficulty in assessing the immediate effects of drugs. In this instance the improvement in exercise tolerance which followed the injection of saline would have been attributed to tolazoline ("priscol") if the control injection had been omitted. Whenever pain is "measured" it

FIG. 1.—Spontaneous improvement in a patient aged 51 with intermittent claudication while receiving inert tablets for 300 days. The improvement is shown by an increased capacity to take exercise and a decreased duration of pain. The rate of walking (mean time per circuit) did not alter significantly (reproduced, by permission, from the *Quarterly Journal of Medicine*, 1952, 21, 169).

must not be forgotten that the figure is an index of a subjective phenomenon and as such may be strongly influenced by suggestion.

A more complete investigation of the effect of natural vitamin E on intermittent claudication has been reported by Hamilton *et al.* (1953). Using the "double blind" technique, in which neither patient nor observer is aware of the nature of the substances tested, they found no appreciable difference in the response between vitamin E and arachis oil.

Attempts to improve the *blood supply to the skin* and subcutaneous tissues are more successful. Among the simplest is the reflex dilatation of the blood vessels which results from raising the general body temperature. The legs may be exposed. Buerger's exercises may help, although I suspect that reported beneficial effects are largely produced by psychological mechanisms. They are described above in a simple form as item 11 of "Care of the Feet." Vaso-dilator drugs have been used with varying success. Nicotinic acid (50 to 100 mg. three times a day) can be tried. Tolazoline is probably more effective. Goodwin and Kaplan (1951) recorded increased blood flows to the limbs of patients suffering from occlusive vascular disease as judged by observations in reflex heating tests and circulation rates. The drug was given orally in doses of 75 to 300 mg. a day for periods of up to three months. The total effects are, however, less than those of sympathectomy and some patients experience no benefit.

Edwards *et al.* (1952), Droller (1953), and Betts (1954) have reported favourable results from the intra-arterial injection of tolazoline in cases of senile arterial obstruction. After a test dose of 25 mg., further doses of from 50 to

FIG. 2.—The effect of an intravenous injection of normal saline and of 10 mg. of tolazoline ("priscol") in a patient suffering from intermittent claudication. Exercise tolerance, as reflected by the amount and duration of exercise, was increased to a greater extent by saline than by tolazoline (reproduced, by permission, from the *Quarterly Journal of Medicine*, 1952, 21, 169).

100 mg. may be given at weekly intervals. The treatment may produce objective improvement in ischaemic necrosis and symptomatic benefit in patients with persistent cold feet, but has no effect on intermittent claudication.

Many patients with symptoms primarily referable to the skin will improve after sympathectomy, but the selection of suitable cases in the elderly grows more difficult with increasing age.

Symptomatic Relief

Elderly patients often sleep badly and are especially liable to be kept awake by the discomfort which arises from cold feet and cramps. They are often helped by a regular dose of a barbiturate, but it should be remembered that old people often react unusually to these drugs and may become dizzy and disoriented. Simpson (1954) finds methylpentynol ("oblivon," "somesin") in doses of 1 g. a safe and useful hypnotic in the elderly.

There is a further group of patients who develop a painful redness of the feet of the type described by Lewis (1946) as erythralgia. These are best advised to avoid dependency of the limb and to sleep with the feet outside the bedclothes, as the burning sensation is worse when the feet are warm. Sympathectomy should be considered in this type of case. Some patients develop so-called rest pain, which resembles intermittent claudication although it occurs at rest. This usually demands the administration of analgesic drugs, and they are almost always necessary in cases with established gangrene. It is wise to begin with the simple analgesics such as aspirin and phenacetin before resorting to methadone ("physeptone") or morphine ("dromoran"). The morphine group of alkaloids, which cloud consciousness to a greater extent, are best held in reserve. Chlorpromazine ("largactil"), which has a calming effect and tends to distract attention from pain, may prove valuable, especially in disorientated patients.

Treatment of Gangrene

Areas of threatened gangrene should be treated by the methods already described which improve the circulation to the skin. Once necrotic areas have developed, antibiotics should be administered and the areas kept clean and dry and exposed to the air. Pain is usually severe and demands the administration of analgesics. Local application of heat must be avoided. The decision when and where to amputate is best made in consultation with a surgeon. Occasionally occlusion of a main artery leads to a red and tender foot, but usually to massive gangrene, and high amputation is necessary. Diabetics form a special group. As we have seen, the typical lesion is in the smaller vessels and relatively conservative measures are desirable. Walker (1953) has reported good results in diabetic pre-gangrene and gangrene treated with oxytetracycline ("terramycin").

Venous Thrombosis

The elderly are more prone to venous thrombosis than are the young. They frequently have a general slowing of the circulation to the legs and they are more often confined to bed either permanently from general weakness, arthritis, or hemiplegia, or temporarily from conditions such as acute respiratory infections and bouts of heart failure. To diminish this liability to venous thrombosis, the elderly should be confined to bed for as short a time as possible, especially after operations or acute infections. If this is impossible, passive or preferably active exercises of the legs should be instituted, and any complaint of pain in the legs or an unexplained rise of temperature should be immediately investigated with the possibility of venous thrombosis in mind. In established cases the advantages and disadvantages of anticoagulant therapy in the elderly should be carefully weighed. If the patient is in hospital it will usually be considered advisable. Measures such as paravertebral block or ligation of the femoral vein may be advised by a surgeon.

Conclusion

Peripheral vascular disease in the elderly presents special problems. The very fact of survival to old age suggests an arterial system relatively free from degenerative processes. Where symptoms occur the progress of the disease is relatively slow. The obese should be put on a low-fat diet. Diabetes is a common predisposing condition and if present should be treated. Little can be done to help patients with intermittent claudication. Prophylaxis against gangrene is, however, possible and important. It is always wise to give advice to a younger relative as well as to the patient, because the memory for recent events in the elderly is usually poor. When gangrene has developed, pain is severe and badly tolerated, and if amputation is withheld analgesics should be given freely. Diabetic gangrene can usually be treated conservatively with rest and antibiotics. Consultation with a surgical colleague is always advisable.

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ANTICOAGULANTS IN CORONARY DISEASE*

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Before reviewing the use of anticoagulants in obliterative coronary disease, it is desirable first to consider briefly the pathological processes which result in myocardial infarction. Irregular thickening at the expense of the arterial lumen, and rigidity and tortuosity of the arteries, are the outward features of advancing atherosclerosis. Constriction of the channel, leading to a reduction in coronary blood flow, particularly if gradual and progressive, has important consequences. The most remarkable of these is the development of a collateral interarterial circulation, on which the future integrity of the muscle cells depends. As its coronaries become sclerotic the heart strikes a balance between the rate of narrowing and the development of anastomoses. Tissue anoxia appears to be the main stimulus for the development of interarterial anastomoses.

Infarct Formation

It is unfortunate that in clinical work the terms "coronary occlusion," "coronary thrombosis," and "myocardial infarction" continue to be used synonymously. They

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