INTRA-ARTERIAL INJECTIONS IN THE TREATMENT OF PERIPHERAL VASCULAR DISEASE

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Degenerative arterial disease is a pathological process which, in the present state of knowledge, remains a non-reversible infirmity. The pathological picture may vary, and accordingly methods of treatment are numerous, but in all instances there is ischaemia, and whatever the aetiology of the arterial obliteration, the immediate therapeutic problem is to overcome ischaemia. This may be attained by surgical or by conservative means—and in the latter method the usual practice is the administration of vasodilator drugs. Recently such drugs have been administered by the intra-arterial route and we think that this route has proved to be an advance.

The intra-arterial method in the treatment of peripheral vascular disease has been practised for about a decade, though therapeutic substances were being introduced via this route as early as the turn of the century. In 1899 Parlaveochio injected antiseptic solutions into the artery in a case of severe infection of the limbs, and in 1906 Crile and Dolley showed that intra-arterial perfusion with Ringer's solution containing adrenalin and hirudin would overcome cardiac arrest due to anaesthesia. However, it is to the French school of Carrel and Leriche that modern advances in vascular concepts and peripheral arterial surgery are due. In 1923 Sicard and Forestier gave a further impetus by introducing direct angiography with radio-opaque substances injected into the arterial system, and in 1943 Singer seems to have been one of the first to use vasodilator solutions intra-arterially in the treatment of peripheral arterial obliteration.

The Technique

Percutaneous intra-arterial injection is a safe and straightforward procedure, quite suitable for out-patient practice. No special preparation of the patient is required and there is no necessity for an incision to expose the artery. The groin (the majority of cases involve the lower limbs) is cleaned with iodine or other antiseptic solution,

and often no local anaesthetic is required. The femoral pulse is felt at the crural beat and while the left hand palpates and 'immobilizes' the artery, the needle—with syringe attached—is passed into the vessel. The manoeuvre is simple, and though there is no visual guide to the artery the left palpating hand serves as a reliable pathfinder. Accuracy is further facilitated by pelvic elevation and extension-and-rotation of the limb—a practical point well worth noting, especially if the patient happens to be in a sagging bed.

A 20 cc. Record syringe fitted with a long and wide-bored needle is satisfactory. We have found the 5 cm. long, size II, III or IV serum needles, most suitable. One important point, it is essential that the needle be sharp-pointed and short-bevelled. Edwards and Watson advise that the technique is further facilitated by directing the needle against the blood stream, but in our experience it is easier to inject with the stream.

Accuracy of arterial puncture is manifest by the strong pulsation which tends to push back the plunger. The technique of injecting is the same as in any other vessel except that it must be done particularly cautiously and slowly. Mufson has employed a drip method, but this is rarely necessary. The injection terminated, it is important that the needle be withdrawn quickly and local pressure applied at the site of puncture for a few minutes, otherwise there is a tendency to extravasation and haematoma formation.

Substances Injected

Any intravenous vasodilator can be given intra-arterially. Injectable solutions of peroral vasodilators exist, and since the introduction of the arterial route new substances have been tried.

Priscoline (benzyl-imidazoline) was the original vasodilator used by Singer in 1943 with encouraging results. It is a well-known local and general vasodilator without many unpleasant side-effects. Intra-arterially it is usually given in doses of 50 to 100 mg. in 10 to 20 cc. of saline. *Papaverine*

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administered in a dosage of 40 mg. in 20 cc. saline is reported to give satisfactory selective vasodilatation, with less side-effects than Priscoline. *Acetylcholine* has been found satisfactory by Oudot and Stolac, and *Histamine* has been administered by Mufson via an intra-arterial drip. Since the work of Leriche and Fontaine *Novocaine* has been widely used for ganglion blocking. Its *procaine* form is now administered intra-arterially both in its own right or, and more often, in conjunction with other vasodilators, such as *nicotinic acid*. Pronestyl (*procaine amide hydrochloride*) unites well with these two, and workers on the Continent and in this country (Forty) have successfully used a mixture of 10 cc. Pronestyl+100 mg. nicotinic acid+5 cc. procaine 1 per cent. injected intra-arterially. We have had very good results with this solution. *Alcohol* has been tried by Edwards *et al.*, who have found it very satisfactory as a vasodilator. They have noticed no central or other side-effects following its administration intra-arterially. They give it via a pressure-drip in doses of 15-20 ml. absolute alcohol in 150-180 ml. of saline. We have recently been trying *Ronicol* (β -pyridyl carbinol) and preliminary results are quite encouraging. Other substances which have been reported to give more or less good vasodilatation are *Hydrgine*, *curare*, *hexamethonium*, *adrenalin* and *Coramine* administered intra-arterially.

Comment

Intra-arterial injection will give a more adequate concentration of the drug at the site of the lesion than that obtained by any other route of administration. Some authors in Bordeaux have even tried to lengthen this sojourn of the drug in the artery by compressing the limb above the site of the injection, but without this the concentration is already higher than that obtained by intravenous, peroral or local topical administration.

In peripheral vascular disease *prognosis depends on the return of blood to the principal channel distal to the obliterated segment or segments* (Leriche). This can be attained by surgical or medical means. However, not all cases are suitable for surgery, in which instance conservative treatment with vasodilator drugs becomes of increased value. There are different methods for such vasodilatation, but if substances are left to act over the whole body, the dilated normal vascular system will divert the blood from the ischaemic limb, thus doing more harm than good. The ideal vasodilator would, of course, be that which would have an intense selective action on one given ischaemic territory without altering the capacity of the vascular system,

the arterial pressure or the blood volume. This ideal vasodilator does not exist, and in its absence we think that some selective action is obtained by the intra-arterial rather than by any other route of administration of a general vasodilator. Another advantage is that by such localization side-effects will also be minimized. It has further been suggested that repeated puncture of the arterial wall may act as a periarterial sympathectomy.

There is naturally a hesitation in accepting this percutaneous intra-arterial route, not unlike the fear of intravenous injections when they were first suggested. However, experience shows that the method is quite safe and unpleasant sequelae rare. The objection that repeated injections may cause an aneurysm or an intramural haematoma at the site of puncture has not been substantiated by experience, and in one case of Buerger's disease, where we gave more than 100 injections at the same site (solution of procaine+Pronestyl+nicotinic acid, daily) we noticed no untoward sequelae.

From the appreciation of different authors who have used this route and from our own observations of cases with varying degrees of peripheral arterial obstruction we have come to believe that intra-arterial administration of vasodilator substances is a valuable procedure in the conservative treatment of peripheral vascular disease.

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Summary

The advantage of the intra-arterial route for the administration of vasodilators in peripheral vascular disease is stressed. The technique of the injection is described and the drugs used are enumerated. The physiological basis for the choice of this route is discussed.

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