agents combined with resuscitative expertise ensures that the anaesthetist has a place in the emergency management of patients suffering from drug overdose. These skills are also valuable in controlling patients with persistent convulsions. Many fatalities associated with acute myocardial infarction may be avoided by skilful dysrhythmia control and early defibrillation in ventricular tachycardia and fibrillation. The anaesthetist, who is familiar with the pharmacological control of arrhythmias and with the defibrillator from his experience in the operating room, has a definite contribution to make as both teacher and participator.

Conclusion

The anaesthetist has a fundamental role in the immediate care of the critically ill and injured patient. Participation in the accident and emergency services at all stages is but one example of the breadth of skill that members of the specialty can offer in the care of patients, both inside and outside the operating room. The wide scope of interest and participation is an essential element in making the present-day work of an anaesthetist so varied and satisfying.

References

1 Easton K. Immediate care. In: Easton K, ed. *Rescue emergency care.* London: Heinemann, 1977:174.
2 Chamberlain DA, White NM, Binning R, Parker WS, Kimber ER. Mobile coronary care provided by ambulance personnel. *Br Heart J* 1973;35:550.
3 Baskett PJF, Diamond AW, Cochrane DF. Urban mobile resuscitation—training and service. *Br J Anaesth* 1976;48:377-85.
4 Stewart RD. The training of paramedical personnel. In: Norman J, Moles M, eds. *Management of the injured patient.* London: MacMillan, 1978.
5 Moles TM. Planning for major disasters. In: Norman J, Moles M, eds. *Management of the injured patient.* London: MacMillan,1978.
6 Marshall RD. A year of resuscitation. *Anaesthesia* 1966;21:86-91.

Lesson of the Week

Accidental intra-arterial injection of diazepam

MYRDDIN REES, JOHN DORMANDY

Intravenous diazepam is widely used for treatment of patients in convulsive states and as a premedication for minor surgery. Because it is easy to use and safe and allergic reactions are rare, and because it produces varied degrees of desirable amnesia, diazepam is used routinely in most gastroenterology units before endoscopy. In the past four years two patients out of about 8000 prepared in this way suffered serious injury from the accidental injection of diazepam into an artery. We suggest how to manage such an accident.

Accidental intra-arterial injection of diazepam causes pain that radiates distally, but clinical signs of ischaemia and gangrene may not occur for days.

Case reports

Case 1—A 73-year-old man underwent oesophago-gastroduodenoscopy for a chronic duodenal ulcer. During the injection of diazepam through a cannula on the dorsal and radial aspect of the right wrist the patient complained of pain in the hand. This subsided, and he was discharged the same day. The next day he returned complaining of intense pain in the thumb and index finger. On examination his hand looked normal, wrist pulses were palpable, and sensation was normal. He was therefore reassured but returned the following day. In addition to the same pain there was discoloration, decreased sensation, and poor capillary return of the distal aspect of the right thumb and index finger. Severe ischaemia in the distribution of the radial artery was diagnosed and the artery explored under general anaesthesia. An operative arteriogram showed obstruction of the first and second digital arteries. A regional streptokinase infusion was started through a fine cannula inserted into a small branch of the radial artery. Heparin was substituted for the streptokinase after three days and continued for a further three days. During this period the hand became oedematous and was raised. The pain gradually subsided and the circulation improved, but a month after the initial accident the pain recurred with further discoloration of the distal part of the same two digits, which required partial amputation. He made an uneventful recovery but again complained of increasing pain in the amputated digits, which was relieved by a cervical sympathectomy. He has had no further pain since.

Case 2—A 53-year-old woman underwent colonoscopy for iron-deficiency anaemia, during which 15 mg diazepam was injected through a cannula inserted in the middle of the ventral aspect of the left forearm. She came back to the casualty department the next day complaining of pain along the ulnar side of the left hand, but there were no abnormal local signs. She was given a soft collar for a presumptive diagnosis of cervical spondylosis. She returned two days later with the same pain accompanied by discoloration of the ulnar side of the middle finger, the radial side of the little finger, and the hypothenar eminence. Acute ischaemia was diagnosed and the puncture mark was noted to be overlying a superficial pulsating vessel in the midline proximal to the wrist joint on the ventral aspect. Both radial and ulnar pulses were present and of equal

St George's Hospital, London
MYRDDIN REES, MB, FRCS, registrar

St James's Hospital, London
JOHN DORMANDY, MB, FRCS, consultant surgeon

volume to the pulses on the normal side. The same day she underwent a brachial plexus block with lignocaine, and intra-arterial injection of procaine and heparinised saline via the brachial artery. This produced an improved capillary return, and thereafter she received an intravenous infusion of low-molecular-weight dextran. (A percutaneous arteriogram confirmed the abnormal course of the ulnar artery but showed no arterial block.) Initially she had complete ulnar and patchy median nerve sensory loss with motor impairment of both nerves. One month later a cervical sympathectomy was performed for persistent pain in the affected digits with a good result. Power and sensation gradually improved, with no return of the pain.

Comment

Five cases of accidental intra-arterial diazepam have been reported.[1-4] Vascular damage occurred in all cases, and one required distal limb amputation. The important clinical points are that the peripheral pulses were well preserved, and a persistent, intense burning sensation may be the only effect for some days. In particular, the pain radiates distally from the site of the injection. Oedema, skin discoloration, and sensory loss may occur within hours, but their absence should not rule out the diagnosis as it did in both cases reported here.

Spasm of the artery and crystallisation of the drug are among the many suggested causes. Knill and Evans,[5] however, showed an immediate direct lytic action on arteriole and capillary endothelial cell membranes after intra-arterial injection of diazepam in rabbits' ears, leading to leakage of fluid and late onset at seven to 10 days of secondary intra-arterial thrombosis and gangrene. The effect was not seen after injection of non-lipid soluble drugs or the solvents of diazepam. Their work, as well as in-vitro studies,[6] suggest that the damage is related to the concentration of the drug.

Accidental arterial punctures are usually due to anatomical abnormalities—when the ulnar or radial artery lies superficially—or technical errors—when the scarcity of superficial veins may lead to a deep search in the antecubital fossa. Great care must therefore be taken before injecting diazepam if local complications are to be avoided. Intravenous sequelae have a similar histological basis,[7] and Hegarty and Dundee[8] have shown that the incidence of thrombophlebitis doubled by seven to 10 days after injection but was appreciably less when large antecubital veins (6%) than when smaller hand or wrist vessels (23%) were used. If the recommended injection rate of less than 0·5 ml/min is adhered to then an error may be recognised earlier; and if pain radiates distally, indicating an intra-arterial injection, it is recommended that the needle is left in place and the artery flushed with a vasodilator such as papaverine or procaine. The resulting increase in blood flow may reduce the concentration of the drug and prevent lysis of the membrane. Animal studies[9] suggest that a high dose of intravenous methylprednisolone may help to stabilise the endothelial membrane and also produce peripheral vasodilatation.[10] Prostacyclin may be of value in the future because of its vasodilatation effect and powerful ability to prevent platelet aggregation.

If the cannula has been removed and more than a few hours have elapsed, the aims of treatment must be to relieve pain; reduce oedema by raising the hand; and improve the blood flow by sympathetic blockade using repeated bupivacaine, brachial plexus blocks, or cervical sympathectomy if pain persists; and finally to prevent secondary thrombosis by intravenous heparinisation, which should be replaced by oral anticoagulants such as warfarin after 10 days. The relapse by the first patient (case 1) after four weeks shows the need to continue anticoagulation treatment for some months while the endothelium recovers.

Requests for reprints to Mr J Dormandy, FRCS, vascular department, St James's Hospital, Sarsfield Road, London SW12.

References

1 Schneider S, Mace JW. Loss of limb following intravenous diazepam. *Pediatrics* 1974;**53**:112-4.
2 Gould JD, Lingam S. Hazards of intra-arterial diazepam. *Br Med J* 1977;ii:298-9.
3 Davies G. Letter. *Can Anaesth Soc J* 1977;**24**:418-9.
4 Divekar VM, Kandar BM, Prabhakar UM. Accidental intra-arterial injection of thiopentone and diazepam on the dorsum of hand. *Indian J Anaesth* 1978;**26**:291-3.
5 Knill RL, Evans D. Pathogenesis of gangrene following intra-arterial injection of drugs: a new hypothesis. *Can Anaesth Soc J* 1975;**22**:637-46.
6 Seeman P. The membrane actions of anaesthetics and tranquillizers. *Pharmacological Reviews* 1972;**24**:585-7.
7 Graham CW, Pagano RR, Katz RL. Thrombophlebitis after intravenous diazepam—can it be prevented? *Anaesthesia and Analgesia Current Researches* 1977;**56**:409-13.
8 Hegarty JE, Dundee JW. Sequelae after the intravenous injection of three benzodiazepines—diazepam, lorazepam, and flunitrazepam. *Br Med J* 1977;ii:1384-5.
9 Enlae G, Sylvester M, Morris LE. Hazards of arterial injection of hydroxyzine. *Can Anaesth Soc J* 1969;**16**:425-8.
10 Motsay GJ, Alho A, Jaeger T, Dietzman RH, Lillehei RC. American Physiological Society symposium on physiological basis of circulatory shock. *Fed Proc* 1970;**29**:1861-73.

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Many heroin addicts have switched over to cyclizine/dipipanone (Diconal), often taking seven to eight tablets a day. What are the long-term toxic effects in these patients, who are usually young people? Does the previous habit of heroin addiction add to the hazard? Does a reduction to three to four tablets a day significantly reduce the risk?

Addicts who take cyclizine/dipipanone (Diconal) often inject crushed tablets intravenously. This may lead to acute reactions and death. Apart from damage to the vascular bed of the lung and other more general effects, the local effects may be severe—thromboses and inflammation of the veins used, with subsequent sclerosis and local sepsis. When the compound leaks from the veins into surrounding tissues it sometimes appears to interfere with lymphatic drainage and leads to lymphoedema. The drug is prescribed frequently by general practitioners and others to opiate addicts, sometimes knowingly and sometimes unwittingly. There are no acceptable medical grounds for prescribing cyclizine/dipipanone to an addict to sustain his addiction. Whether or not the addict has used heroin or some other opiate previously will make no difference to the risks. A prescribing doctor has a responsibility to see that he is not being used as an unwitting source of supply for addicts, who may be skilled, plausible, and persistent in obtaining their ends. Dipipanone hydrochloride, which is contained in Diconal, is a substance controlled as a class A drug by the Misuse of Drugs Act 1971. Any prescription of this drug to an addict should lead to notification of the addict to the Chief Medical Officer at the Home Office (Drugs Branch, Queen Anne's Gate, London SW1. Telephone 01-213 3403). If a maintenance prescription for an opiate is to be given it should be oral methadone mixture (drug tariff formula), and anyone requiring such treatment should be referred to an appropriate clinic or specialist. Three to four tablets daily would be little better than seven to eight tablets daily since they should not be prescribed at all to addicts.

As it is now fashionable to eat sprouting seeds would it be safe and palatable to eat the sprouts on old potatoes as food rather than discarding them?

No, it could be positively dangerous to eat potato sprouts. The glycoalkaloids (solanine and chaconine, for example) are often present in high concentrations in the sprout tissue—as high as 400 mg/100 g, in contrast to a value of about 10 mg/100 g or less in the potato flesh. Some varieties of potato that were found to contain 50 mg/100 g flesh were withdrawn from use because the concentration of glycoalkaloids was considered unsafe.