circulation.¹⁰ I.C.I. 66082 would therefore be a more appropriate β -blocker to use in those at risk of developing cardiac failure. In our patients there was no evidence of cardiac failure while on I.C.I. 66082. I.C.I. 66082 has two other theoretical advantages: it lacks membrane stabilizing activity, which in extremely high doses is thought to delay cardiac conduction, and it has been shown in animals that I.C.I. 66082 does not cross the blood brain barrier (I.C.I. introductory animal experiments) and is therefore less likely to cause the troublesome dreams reported with some other β -blockers.¹¹

In our highly selected group of patients, each of whom acted as his own control, I.C.I. 66082 was found to be superior to practolol and placebo in all values assessed. The number of anginal pains and amount of trinitrin consumed in patients on I.C.I. 66082 was significantly reduced ($P < 0.001$ and $P < 0.03$ respectively).

The improved ability to exercise on the bicycle ergometer while taking I.C.I. 66082 was not as great as perhaps expected from the reduction in trinitrin intake. It was not uncommon to find that a patient expressed a feeling of wellbeing and a reduced incidence of anginal pains during a particular two-weekly period and yet showed no dramatic change in his work performance on the bicycle ergometer.

Each patient took I.C.I. 66082 for a total of six weeks, and during this time no side effects were noted. Skin and eye changes were especially looked for. Haematological and biochemical values remained normal.

We therefore conclude that I.C.I. 66082 in a selected group

of patients with severe angina pectoris significantly reduced the frequency of anginal attacks and the need to take trinitrin tablets. It was effective in the convenient dosage of 50 mg twice a day (one tablet twice daily).

We thank Mrs. G. Lockton, cardiac technician, Guy's Hospital, for her enthusiastic co-operation; the pharmacy staff at Guy's Hospital for their help; Dr. W. Simpson of I.C.I. for supplies of the drugs and his advice; and Mr. J. A. Lewis for statistical analysis of the results.

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References

- Gillam, P. M. S., and Pritchard, B. N. C., *American Journal of Cardiology*, 1966, 18, 366.
- Keelan, P., *British Medical Journal*, 1965, 1, 897.
- Wilson, D. F., and Turner, A. S., *New Zealand Medical Journal*, 1968, 67, 406.
- Aellig, W. H., Pritchard, B. N. C., and Richardson, G. A., *British Journal of Pharmacology*, 1969, 37, 527.
- Barrett, A. M., et al., *British Journal of Pharmacology*, 1973, 48, 340.
- Astrom, H., and Vallin, H., *British Heart Journal*, 1974, 36, 1194.
- McNeill, R. S., *Lancet*, 1964, 2, 1101.
- Pritchard, B. N. C., Lionel, N. D. W., and Richardson, G. A., *Postgraduate Medical Journal*, 1971, 47, Jan. Suppl., 59.
- Sowton, E., Das Gupta, D. S., and Baker, I., *Thorax*, 1975, 30, 9.
- Hamar, J., and Sowton, E., *British Heart Journal*, 1965, 27, 892.
- Wiseman, R. A., *Postgraduate Medical Journal*, 1971, 47, Jan. Suppl. 68.

Arterial Occlusion after Cannulation

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Summary

The occurrence of ischaemic changes, arterial occlusion, and other complications which may follow percutaneous arterial cannulation was assessed in a survey of 155 patients. No patient complained of or had signs of ischaemic damage though signs of arterial occlusion were found in 33 patients (22%). These signs were significantly more common after periods of cannulation greater than six hours (43%) than after less than six hours cannulation (17%). During recovery from occlusion all patients had palpable pulsation over the artery even though blood flow seemed to be absent. By the end of follow-up blood flow had returned in 19 of the 33 occluded arteries.

Introduction

Percutaneous arterial cannulation has been performed increasingly often over the last few years, both for continuous direct

measurement of the arterial blood pressure and to facilitate repeated blood gas analysis, in spite of the danger of producing ischaemic changes in the limb distal to the cannulation site. Reports of permanent damage such as ischaemia of fingers or muscle wasting near the puncture site seem rare, and a review of 16 studies which included 4566 patients found that the incidence of such severe complications was 0.3%.¹ Occlusion of the artery, however, has resulted from cannulation in many patients without producing subjective or objective signs of ischaemia.^{2,3}

We undertook a prospective study to assess the incidence of arterial occlusion and ischaemic changes in patients cannulated by members of the Nuffield Department of Anaesthetics and the relative importance of some of the factors involved in the development of these complications.

Method

A form was completed at the time of cannulation to provide information about the patient and the cannulation procedure.

Post-cannulation observations were all made by one anaesthetist who interviewed patients on the first, third, and seventh days after removal of the cannula. In patients with arterial occlusion more frequent observations were made over a longer period. At each interview the cannulation site and the limb in which it was situated were carefully examined and symptoms referable to the area were asked for. A note was made of the presence of haematoma (bleeding into the tissues with consequent swelling) at the cannulation site, bruising of the skin, and oedema in the limb. Infection was judged to be present when pain, erythema, and oedema were present at the cannulation site.

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On each occasion, the presence of occlusion was evaluated; the method used depended on whether the radial or the brachial artery had been cannulated. The patency of the radial artery was assessed using a modification of Allen's test.⁴ On the suspect arm both the radial and ulnar arteries were occluded manually. The patient was then asked to exsanguinate the hand by repeated clenching until it looked white. Pressure on the radial artery was then released. The absence of a pink flush in the hand within five seconds suggested that blood flow in the artery was reduced, and if no flush had occurred within 30 seconds the artery was considered to be occluded. In some patients with sluggish peripheral circulation we had to obtain a comparative time for flushing in the normal limb. Occlusion of the brachial artery was assumed if the pulses in both brachial and radial arteries were absent or only weakly palpable and if measurement of the blood pressure by auscultation over the brachial artery was not possible.⁵

Results

Over five months 155 arterial lines were inserted, though observations were made on only 146 (94%) of these patients because nine died with the cannula in situ or shortly after decannulation. The radial artery was used in 131 patients, in two-thirds of whom the left side was chosen, and the brachial artery was used in 20 patients. Gauge 20 or 18 parallel-sided Teflon cannulae (Becton Dickinson Longdwell) were used in 124 cases and tapered polypropylene cannulae (Argyle Medicut) in the remaining 31. "Direct" and "transfixion" methods for insertion of the cannulae into the arteries were used with similar frequency. All cannulae were used for continuous blood pressure monitoring, though in 61 patients the arterial line was also used as a sampling site for the analysis of arterial blood gases. Most cannulae were inserted for periods of less than six hours (see table) but in only five patients were they said to have failed and removed early.

Complications after Arterial Cannulation and Length of Cannulation Period. Results are Numbers of Patients. Figures in Parentheses are Percentages of Total in Each Time Group

Length of Cannulation (hours):	0-3	-6	-24	-72	Total
No. cannulated ..	63	53	11	19	146
No. without complications ..	16 (25)	15 (28)	2 (18)	1 (5)	34 (23)
No. with ≥1 complications: ..	47 (75)	38 (72)	9 (82)	18 (95)	112 (77)
Occlusion ..	14 (22)	6 (11)	5 (45)	8 (42)	33 (22)
Bruising ..	40 (64)	32 (60)	5 (45)	11 (58)	88 (60)
Haematoma ..	7 (11)	6 (11)	3 (27)	5 (26)	21 (14)
Oedema ..	6 (10)	1 (2)	4 (21)	4 (21)	11 (8)
Infection ..	1 (2)	1 (2)	1 (9)	1 (5)	3 (2)
Pain ..	7 (11)	8 (15)	3 (16)	3 (16)	18 (12)

Complications were observed in 112 of the 146 patients who were followed up (see table), though none gave rise to serious or permanent dysfunction. Local oedema around the cannulation site was noted in 11 patients in all of whom the contributory effect of a closely sited intravenous infusion could not be excluded. In three cases there was evidence of superficial infection but no patient developed a septicaemia. Pain after cannulation was either local, around the site and of short duration, or distant. In the latter case it was usually precipitated by keeping the cannulated limb in a fixed position. This particularly applied to brachial artery cannulation, when patients complained of painful shoulder and elbow joints which took several days to resolve.

Occlusion was shown in the arteries of 33 patients but in no case was it associated with ischaemic skin changes or muscle wasting. In 25 patients arterial occlusion was apparent within 24 hours of decannulation, while in the remaining eight, occlusion only became obvious later (see fig.). In patients from whom cannulae were removed in less than six hours there was a 17% incidence of occlusion, while in those in whom cannulae remained in situ for longer than this period there was a 43% incidence ($P < 0.01$).

The pulse was absent in 24 patients when occlusion was first diagnosed but in the remaining nine patients a normal or weakly palpable pulse was present. By the end of the follow-up period all patients had palpable pulses in the cannulated vessels though several vessels still seemed to be occluded. Fifteen days after decannulation vessel patency had been regained in 13 of the patients, and of the 10

patients who had vessel occlusion at the 15th day, follow-up in six was continued until recannulation occurred. The final outcome in the remaining 14 was unknown (fig. 1). Occlusion of the brachial artery was detected in two patients. There seemed to be no difference between the radial and the brachial artery as a cannulation site when related to the incidence of occlusion or complications.

Relation between cannulation time and appearance of and recovery from occlusion in 33 patients. Lines ending with a question mark show time at which follow-up ceased even though blood flow was still absent.

Discussion

The current popularity of arterial cannulation may be gauged from the fact that during the five-month study 155 arterial cannulae were inserted by anaesthetists at the Radcliffe Infirmary. Prolonged anaesthesia, lack of access to the patient, and the need for constant monitoring of the blood pressure during the use of specialized techniques, such as controlled hypotension and hypothermia, explain why patients undergoing neurosurgery, cardiac surgery, and major vascular surgery comprised the largest groups in the study.

The left radial artery was the most frequently cannulated vessel probably because of a desire to avoid the dominant limb, though the brachial artery was cannulated seldom, perhaps because of the report that the use of this vessel is more likely to lead to complications.²

Though it did not cause signs or symptoms which were noticed by the patient arterial occlusion—judged by the failure of flow in the blood vessel distal to the puncture site—was the most significant complication that occurred in this study. This sequela occurred in 33 (22%) patients. After the use of a "Doppler" method to assess occlusion a 38% incidence was reported by Bedford and Wollman,³ but Mortenson,² relying on the absence of the pulse as the criterion for occlusion, found occlusion in only 10% of his patients. We confirmed the observation that pulsation may be present though the artery seems to be occluded.^{3,6} The presence of the pulse, however, seemed to be an indication of recovery as in all but one of the patients its return preceded the return of blood flow in the vessel.

Unlike others we saw no obvious relation between the size, shape,⁷ or constituent material of the cannula⁸ and the occurrence of occlusion. Local trauma to the artery, gauged by both the number of attempts at insertion and the use of the "transfixion" technique of introduction, was also unrelated to the incidence of post-cannulation occlusion.

The occurrence of occlusion was, however, clearly related to

the length of the period of cannulation, particularly when this exceeded six hours. There should be a positive clinical indication if arterial cannulation is to be continued for longer than six hours, since the occurrence of overt ischaemic damage will probably be linked, albeit very rarely, to that of arterial occlusion. In the management of seriously ill patients, however, the slight chance of sustaining permanent ischaemic damage distal to the cannulation site must be weighed against the proved benefits of continuous monitoring of arterial blood pressure and ready access to arterial blood for respiratory gas analysis. The risks associated with arterial cannulation have yet to be compared with those of the multiple arterial punctures otherwise necessary to obtain information.

We thank our colleagues of the Nuffield Department of Anaesthetics for their co-operation and help in providing the basic information upon which this survey was based.

References

- ¹ Zorab, J. S. M., *Anaesthesia*, 1969, **24**, 431.
- ² Mortenson, J. D., *Circulation*, 1967, **35**, 118.
- ³ Bedford, R. F., and Wollman, H., *Anesthesiology*, 1973, **38**, 228.
- ⁴ Allen, E. V., *American Journal of Medical Science*, 1929, **178**, 237.
- ⁵ Jeresaty, R. M., *American Heart Journal*, 1968, **76**, 481.
- ⁶ Brown, A. E., Sweeney, D. B., and Lumley, J., *Anaesthesia*, 1969, **24**, 532.
- ⁷ Downs, J. B., *et al.*, *Anesthesiology*, 1973, **38**, 283.
- ⁸ Bedford, R. F., *Anesthesiology*, 1975, **42**, 219.

Pyogenic Cocci in Infantile Eczema throughout One Year

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Summary

To determine the source of pyococci causing attacks of sepsis in infantile eczema 20 patients with continuing eczema were followed up for one year, regular swabs being taken from the skin, nose, throat, and family contacts. The staphylococci were phage typed and the streptococci serologically typed.

Staphylococci of the same phage type in most cases remained in reservoir sites on the skin and coincidentally in the nose. Staphylococci causing attacks of clinical sepsis arose from these persistently colonized sites. Staphylococci of the same phage type were also common in family contacts.

Streptococci of the same group in most cases did not remain on the skin. Streptococci causing attacks of clinical sepsis arose as new infections from external sources, sometimes from throat infections in the patient or family contacts. Strains of streptococci which are known to be associated with glomerulonephritis were isolated.

It has been confirmed that staphylococci resistant to neomycin and sodium fusidate quickly emerge after the topical use of these antibiotics. Streptococci are highly resistant to neomycin and gentamicin, and moderately resistant to sodium fusidate, so the use of these antibiotics in topical steroid preparations will have little effect in preventing further attacks of clinical sepsis in these patients.

Introduction

One important aspect in the management of patients with persistent infantile eczema is the control of the episodes of clinical sepsis. Such episodes cause urgent consultations and

disruptions of the child's life and normal activities. In many patients the condition is temporarily controlled by antibiotics, but in a few weeks or months a fresh phase of sepsis may occur. The multiple cracks and abrasions, the scaling and exudation, and the repeated trauma all favour secondary infection, but one problem is the origin of the organisms. Do they arrive on the skin from outside sources, or are they the same organisms which have remained in small numbers in some reservoir sites when the clinical infection has cleared?

To try to answer to this question we have studied a series of patients with infantile eczema and followed them up for one year. Regular swabs were taken and the organisms phage or serologically typed.

Method

The patients were taken from those with persistent childhood eczema (atopic dermatitis) attending the outpatient department at the Bristol Children's Hospital. They ranged in age from 16 months to 15 years, and all patients had eczema in at least four of the common sites, including the elbows, wrists, knee and ankle flexures, buttocks, buttock creases, hands and fingers, and the retroauricular area. We selected patients who would probably still have active eczema in a year's time because of its severity and chronicity, and who would be able to attend every few weeks for a year. Twenty-seven patients were admitted to the investigation, but seven failed to attend regularly for the whole year, and their results were discarded.

We used common treatments, including topical steroids. When it was thought to be clinically advisable a topical antibiotic—usually neomycin, gentamicin, or sodium fusidate—was also used. Also, short courses of an antibiotic by mouth were occasionally necessary for various infections, and penicillin, clindamycin, flucloxacillin, erythromycin, and oxytetracycline were given. We appreciated that the bacteria flora would to some extent be altered by these antibiotic treatments.

The patients were seen at various intervals from two to eight weeks, but usually every four weeks. Saline-moistened cotton wool swabs were taken from the nose, throat, and the most active eczema site. The clinical appearance of the eczema was noted, and a history of any septic lesion in the immediate family contacts was taken. Any family member accompanying the child had swabs taken from the nose, throat, and any lesion present. The parents were encouraged to bring other members of the family, but we could not screen the whole family in each case. The cotton wool swabs were plated within four hours on to nutrient blood agar medium and incubated aerobically and anaerobically for 24 hours.

The coagulase-positive staphylococci were then tested for their antibiotic sensitivities by means of a Multodisc (Oxoid), and phage typed by the method of Blair and Williams¹ with the international basic set of phages.²

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