Arterial Puncture

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Arterial puncture is now commonly used for clinical and research purposes, but it is still regarded with suspicion in some quarters (Mushin, 1964). During the past 10 months we have followed up 77 patients on whom 160 arterial punctures were performed and have recorded any complications that occurred. The majority of punctures were performed to help in diagnosis or treatment, but a small number were for purposes of research.

Method

No. 1 (21 S.W.G. 0.9 mm. outside diameter) and No. 12 (23 S.W.G., 0.7 mm. O.D.) needles were employed throughout the series. We had previously found difficulty in obtaining samples with No. 20 (26 S.W.G., 0.45 mm. O.D.) needles, though Marshall (1964) states that this is practicable. Five-millilitre siliconed all-glass syringes were used for collecting the blood, and the dead-space (0.2-0.4 ml.) of the syringe and needle was filled with heparin (heparin injection B.P. 1,000 I.U./ml.). At least 4 ml. of blood was taken for each sample to minimize the heparin dead-space effect. The arteries punctured were the femoral, the brachial, and the radial, the choice being left to the anaesthetist performing the puncture. In some patients the radial artery was compressed for three minutes before puncturing in order to assess ulnar-palmar circulation. Conscious patients were warned that the puncture might be more painful than venepuncture. Local anaesthetic was not used, as this had been found to hinder palpation and obscure the artery, making identification and puncture more difficult. Experience has shown that a local anaesthetic in fact is not necessary.

The needle with the syringe attached was introduced through the skin at an angle of 60° to 70° to the femoral artery, 45° to the brachial artery, and 30° to the radial artery. The needle was advanced until arterial pulsation was transmitted to the needle; the arterial wall was then pierced and the blood allowed to flow freely into the syringe, the plunger being pushed back by the pressure of the blood. After collection of the sample the needle was withdrawn and digital pressure applied for three to five minutes by the anaesthetist, a nurse, or the patient himself. Any arterial spasm, pain, or paraesthesia was noted.

Patients were followed up one, three, and seven days after puncture. The site was carefully examined and the following points were recorded: puncture wound, bruising or haematoma formation, and the presence of arterial pulsation.

A total of 160 arterial punctures were performed on 77 patients. Not infrequently more than one puncture was made on the same artery. Histological specimens of arteries were obtained from two patients at necropsy, 36 hours after the last puncture, and these were examined macroscopically and microscopically.

Results

It was difficult to get an adequate flow with a No. 12 needle; the wide bore of the No. 1 needle made sampling much easier.

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One patient complained of transient paraesthesia immediately digital pressure was applied after radial artery puncture—this disappeared on relaxing the pressure. All conscious patients experienced transient discomfort during puncture; but this was mild, and no patient refused a second puncture. One child, aged 13, had spasm with pallor of the hand after brachial artery puncture. Procaine was injected around the artery, and distal pulsation returned within three minutes. In no other patient was there any interference with pulsation of the artery distal to the puncture site. There was a high percentage of bruising with both sizes of needle at all sites (see Table). Radial artery punctures produced the highest incidence, perhaps because the superficial position of the artery made bruising more obvious. Femoral haematomas could sometimes be palpated although not seen. The incidence of haematoma increased with repeated punctures, and, as would be expected, in those patients with a low prothrombin index. By the third day haematomas were always smaller, and sometimes had disappeared; by the seventh day no evidence of puncture was ever seen.

Percentage of Bruising Found

Artery	Needle Size 1			Needle Size 12		
	Total No. of Punctures	Bruising		Total No. of Punctures	Bruising	
		Absent	Present		Absent	Present
Femoral	27	16	11 (40.8%)	12	10	2 (16.6%)
Brachial	15*	9	4 (26.6%)	5	2	3 (60.0%)
Radial	70	48	22 (31.4%)	31	20	11 (35.5%)

* 2 patients died before follow-up.

Histology.—In the two patients who died from other causes about 36 hours after the last puncture macroscopic haemorrhage at the puncture sites was clearly seen extending through all layers to the skin. In 10 puncture sites examined microscopically the needle holes were extremely difficult to differentiate from arterial branches. There was damage at one puncture site only, and this showed extrusion of intimal and medial layers through the adventitia; this may have been due to a barbed needle.

Discussion

Various authors have suggested that capillary blood from a vasodilated extremity can be used as a measure of arterial PCO_2 and pH (Singer *et al.*, 1955; Brooks and Wynn, 1959; Siggaard Andersen *et al.*, 1960; Siggaard Andersen, 1961; Mass and Van Heijst, 1961). Langlands and Wallace (1965) also state that blood from the hyperaemic ear lobe can be used for PCO_2 , PO_2 , and pH measurements. In our experience capillary blood is often difficult to produce, but once bleeding occurs it is sometimes copious and difficult to stop. It is always difficult to keep the sample completely anaerobic. In patients with poor peripheral circulation capillary sampling is almost impossible, and the sample is usually inadequately arterialized. We believe that arterial sampling is preferable to capillary sampling; it produces only minor discomfort to the patient, and with good technique the sample is always uncontaminated by atmospheric oxygen, and, of course, is true arterial blood.

We have not included in this series patients having indwelling catheters, cannulae, or large-bore needles, though one patient is included who after having an indwelling polyethylene catheter for six hours was punctured at the same site three hours later without any difficulty. We have also omitted radiographic procedures from our series, as these involve large-bore needles, insertion of cannulae, and injection of contrast media.

We agree with Simpson (1964) that careful attention to technique is essential, and that leakage and bruising do sometimes occur but have little effect. The amount of bruising does not seem to depend on the size of the needle, and can be minimized by efficient pressure for three to five minutes to the puncture site immediately after the needle has been withdrawn.

Summary

A total of 160 arterial punctures performed with No. 1 and No. 12 needles are reviewed. No serious sequelae were encountered. Bruising and haematoma formation were the commonest complications. Conscious patients experienced

transient discomfort during the procedure but no patient refused a second puncture.

One patient experienced transient paraesthesia with digital compression of the radial artery, and in another patient spasm of the brachial artery after puncture was successfully treated with locally injected procaine. We feel that arterial puncture may safely be used for diagnostic and therapeutic purposes. The decision to use any technique for research in patients for whom it is not required for diagnosis or treatment presents an ethical problem.

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REFERENCES

- Brooks, D., and Wynn, V. (1959). *Lancet*, **1**, 227.
Langlands, J. H. M., and Wallace, W. F. M. (1965). *Ibid.*, **2**, 315.
Maas, A. H. J., and Van Heijst, A. N. F. (1961). *Clin. chim. Acta*, **6**, 34.
Marshall, B. E. (1964). *Lancet*, **2**, 40.
Mushin, W. W. (1964). *Brit. med. J.*, **2**, 310.
Siggaard Andersen, O. (1961). *Scand. J. clin. Lab. Invest.*, **13**, 196.
— Engel, K., Jørgensen, K., and Astrup, P. (1960). *Ibid.*, **12**, 172.
Simpson, T. (1964). *Brit. med. J.*, **2**, 510.
Singer, R. B., Shohl, J., and Bluemle, D. B. (1955). *Clin. Chem.*, **1**, 287.

Preliminary Communications

A New Pharmacological Action of Emetine

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The incidence, nature, and mechanisms of the untoward reactions to emetine have been reviewed by Klatskin and Friedman (1948). They indicated that emetine is a general protoplasmic poison with a predilection for muscle and possibly nerve tissue, not only of the heart but also of the vascular, gastro-intestinal, and skeletal systems. They attributed the local reaction to myositis; diarrhoea to increased peristalsis; nausea and vomiting to central stimulation; and the abnormal electrocardiogram to changes within the myocardium.

However, certain manifestations of emetine toxicity in man appear to be brought about by disturbance of balance in the autonomic nervous system. Kanfor (1932), on the basis of displacement of acid-base balance, suggested that emetine hydrochloride affected the "vegetative nervous system through strong stimulation of its parasympathetic section." Chopra, Gupta, and Roy (1935) found that emetine reduced the adrenaline content of the adrenals in Belgian hares. Heilig and Visveswar (1943) suggested that the immediate fall in blood-pressure after intravenous injection in man could be due to vagal stimulation. Perusal of the literature shows that the effect of emetine on the sympathetic-nerve fibre has not been reported. Experiments were made on sympathetically innervated preparations *in vitro*. Evidence is being presented on the adrenergic neurone-blocking activity of emetine.

METHODS

Isolated Rabbit Ileum and Colon.—Observations were made in McEwen's solution at 35° C. bubbled with 95% oxygen and 5% carbon dioxide. The animal was killed and bled out. With the abdomen opened along the midline, segments of ileum or colon 1½ to 2 in. (3.8 to 5 cm.) long were removed, together with the mesenteric vessels, according to the method

of Finkleman (1930). They were placed in a beaker containing McEwen's solution through which a stream of 95% oxygen and 5% carbon dioxide was passed. A segment was then transferred to a Petri dish, where a thread was tied round the artery. This enabled the perivascular nerves to be pulled through the hole of the bipolar electrode described by Burn and Rand (1960). The preparation was mounted in a 50-ml. organ bath, and the movement of the ileum was recorded kymographically by means of an isotonic lever.

Isolated Guinea-pig Vas Deferens.—The guinea-pig was killed by a blow on the head. With the abdomen opened, the vasa deferentia were removed from the adjacent tissues, the testes, and the prostate gland. To stimulate the post-ganglionic sympathetic fibres the method described by Bentley and Sabine (1963) was employed. This consisted of a platinum electrode inserted into the lumen of the vas deferens, with a second platinum electrode forming a loop around the vas deferens. Observations were made in 50 ml. of McEwen's solution at 35° C. bubbled with 95% oxygen and 5% carbon dioxide. Isotonic contractions were recorded by a frontal lever writing on a smoked drum.

From an electronic square-wave stimulator supramaximal stimuli of 0.5 or 1 msec. duration were delivered at a frequency of 20 pulses per sec. for 10 seconds, and repeated at intervals of two to four minutes.

Emetine hydrochloride and noradrenaline acid tartrate were used; the former was expressed in terms of the salt and the latter referred to the base.

RESULTS

The isolated rabbit ileum showed spontaneous rhythmic pendular movement, which was inhibited by noradrenaline or stimulation of the perivascular sympathetic nerves. Since the response to nerve stimulation was unaffected in the presence of hexamethonium 1×10^{-4} g./ml., stimuli were therefore applied to the post-ganglionic sympathetic fibres.