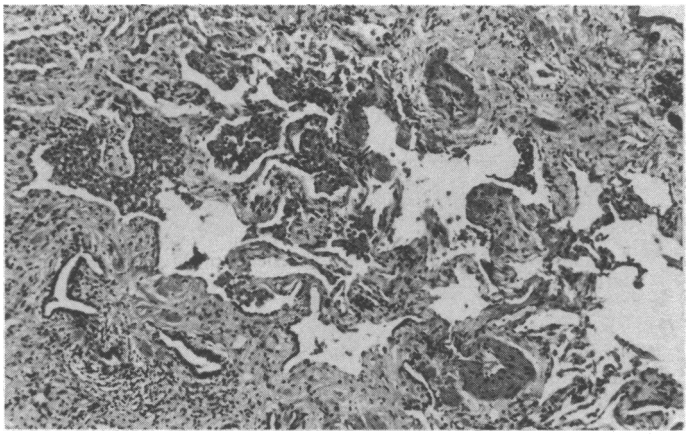
no appreciable interstitial smooth muscle proliferation. Electron microscopy showed variable thickening of alveolar septa with a few smooth muscle fibres present between the collagen fibres. Type II pneumocytes were prominent. No foreign material was detected.



Area of lung showing collections of desquamated cells, interstitial fibrosis, chronic inflammation, and thick-walled arteries. Haematoxylin and eosin $\times 100$ (original magnification).

Comment

There was no history of inhaled extrinsic fibrogenic material or ingestion of other drug or toxin and no evidence of systemic disease. A diagnosis of "classical" cryptogenic fibrosing alveolitis was unlikely in the absence of finger clubbing. A similar pulmonary reaction occurs after treatment with practolol[1] but has not been reported with pindolol. Practolol and pindolol are structurally different from propranolol, oxprenolol, and alprenolol in having a nitrogen atom attached to an aromatic ring, producing a stereochemical configuration similar to methysergide which is well known to produce fibrosing reactions.[2] A common stereochemical structure may be implicated in the fibrosing reactions induced by these drugs.

[1] Erwteman, T M, Braat, M C P, and Van Aken, W G, *British Medical Journal*, 1977, **2**, 297.
[2] Hall, O R, Morrison, J B, and Edwards, F R, *Thorax*, 1978, **33**, 822.
[3] Griffiths, R W, *et al*, in *Toxicological Considerations in Ergot Alkaloids and Related Compounds*, ed B Berde and H O Schild, p 805. New York, Springer-Verlag, 1978.

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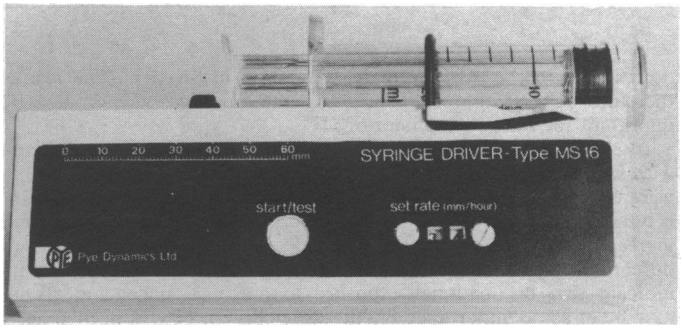
Slow drug infusions using a portable syringe driver

Motor-driven syringes, often called "syringe pumps," have been available for many years for the slow infusion of drugs, but, until recently, they have mostly been cumbersome, expensive, mains-operated machines suitable only for bedridden patients. Most drugs that are now injected periodically would probably be better infused slowly because the blood concentration could be kept in the desired range instead of being much of the time either above or below it. Slow infusions also avoid the disturbance of the patient and the work for the nurses of periodic injections, especially at night. Their scope, however, is limited if used only for bedridden patients, so a portable instrument is clearly essential. In this paper we describe such a device, its mode of use, and performance.

Machine, method, and results

The instrument (figure) is a compact unit measuring $166 \times 53 \times 23$ mm and weighing, with battery, 175 g. The syringe is driven by a bracket riding on a lead screw which is rotated intermittently by a battery-operated motor in response to pulses from an electronic timer. The pulse intervals may be varied by two decade switches to give driving rates from 1-99 mm/h. With a 10-ml syringe each pulse delivers about 0·01 ml, and the pulse intervals vary from a few seconds to several minutes. A PP3 alkaline battery gives a running life of about three months. A shoulder holster is provided for carrying the driver under the clothing, where it is invisible and well



Front view of syringe driver showing controls.

protected. Because it will take almost any syringe the driver is calibrated in mm/h and not ml/h. The driving rate must therefore be calculated by dividing the required length of travel of the piston (measured against a mm scale on the instrument) by the time of delivery in hours. For routine use the dose can be made up to a standard volume so that the rate for a given period is always the same. The rate is set with a screwdriver or similar object in the slotted spindles of the decade switches. These and the starting button are flush, so they cannot be accidentally operated and can be taped over if required.

So far the driver has been used mainly in treating thalassaemia with a daily 12-hour subcutaneous injection of desferrioxamine. More than 1000 instruments have been in use for this purpose in the past year. Since most of the patients are children or adolescents, many in relatively undeveloped countries, this has provided good evidence of the reliability and acceptability of the device.[1] It has also been used in this and other hospitals for heparin infusions, cancer chemotherapy, scalp-vein transfusions, milk feeds, post-operative analgesia,[2] and domiciliary analgesia in terminal cancer,[3] and for giving neostigmine in cases of myasthenia gravis.[4]

Comment

Because of the small volume injected at each pulse nearly all drugs can be given subcutaneously or intramuscularly, the slower absorption being unimportant with a slow infusion. Subcutaneous needles may be left in situ for weeks at a time,[3 4] and the subcutaneous and intramuscular routes are much safer than the intravenous, making possible domiciliary treatment by a community nurse. The device is, we believe, substantially smaller, simpler, cheaper, and more versatile than any other of its kind available. But we expect, and hope, that such syringes will soon become commonplace and will make slow infusion of drugs a routine procedure.

We thank our colleagues in the Clinical Research Centre and Northwick Park Hospital for their interest and encouragement. The instrument, developed from a prototype designed and made by us, is being made and marketed by Pye Dynamics Ltd, Bushey, Herts, and we thank them for their co-operation in its development. The National Research Development Corporation has applied for a patent (BPA No 9947/77).

[1] Pignatti, C B, and de Stephano, P, *British Medical Journal*, 1978, **2**, 1432.
[2] Davenport, H T, and Wright, B M, *British Medical Journal*, 1979, **1**, 1561.
[3] Russell, P S B, *British Medical Journal*, 1979, **1**, 1561.
[4] Bingle, J P, Rutherford, J D, and Woodrow, P, *British Medical Journal*, 1979, **1**, 1050.

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