picture. It seems more likely to have been related to a minimal change glomerulonephritis caused by practolol. This has not previously been described. The long-standing vitiligo may have been a predisposing factor. No electron microscopic studies were made and the patient was not skin tested or rechallenged with practolol.

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Variation of Intravenous Infusion Rates

Effective electromechanical devices to pump drips are available but they are cumbersome and expensive to be used routinely. In 1971 I started to develop a drip controller and monitor which would be simple, reliable, and cheap enough to use with standard disposable drip sets.

Prototype

The device consisted of photoelectric drop detector and an electromagnetic screw clamp. The plate against which the screw acted was the armature of the electromagnet so that when the latter was energized the clamp opened to an extent controlled by the screw. This arrangement greatly reduced the power requirements. The drip rate was controlled by an adjustable electronic timer, and was displayed on dials as "hours per litre" or "drops per minute," thus saving the nurse computations which may be quite troublesome.¹ A flashing light enabled the behaviour of the drip to be observed from a distance or in a darkened ward.

Initial results were promising, especially on slow (five drops/min) infusions of antilymphocytic serum. It was tried on postoperative drips in a general surgical ward and was received with enthusiasm initially, but fell into disuse, because the new device had to be set up differently from all the others and it was impossible to establish a routine. It was decided, therefore, to make six more and these were put into use in the same ward in June 1973. But gradually they were discarded. Another trial in the intensive care unit of Charing Cross Hospital had the same result.

The reasons, apart from mechanical breakdowns, were threefold: The viscosity of the polyvinyl chloride tubing¹ caused a slow drift in the setting of the clamp so that it required several initial adjustments before it settled down; the device required mains power, so that it could not be used in transit from the theatre or on ambulant patients; and variation of drip rate within wide limits is quite acceptable in most cases² so that no device, however simple and reliable, was worth bothering with for routine drips.

Flack and Whyte have illustrated another difficulty with drip monitors.¹ Complete or nearly complete stoppages occur quite frequently but these are not usually noticed, as the drip restarts spontaneously when the compression is removed. A monitoring device draws attention to these stoppages immedi-

ately and an attempt to get the flow going again without clearing the obstruction can lead to a confused situation.

Conclusion

Though the device was simple, a realistic costing of the instrument in 1972 came to at least £100 unless large quantities were made. The insertion of a short section of rubber tubing in the drip set might have solved the technical problems, but it was difficult to justify doing this on all drip sets, so we reluctantly decided to drop the project. A cheap and simple drip controller is not impossible but I think it is unlikely that one can be produced that would be worth its keep for routine drips. The administration of drugs is another matter and justifies the use of a limited number of expensive drip pumps, or of motor driven syringes which are simpler and cheaper. These are available in our intensive care unit but are used only for drug administration.

Though our conclusions were negative our experience may help others thinking of embarking on this kind of enterprise.

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Lymphocyte Transformation in Halothane-related Hepatitis

Hepatitis after halothane anaesthesia follows multiple rather than single administrations. This, together with occasional fever, rashes, or eosinophilia has suggested a hypersensitivity phenomenon.¹ Paronetto and Popper² described stimulation of lymphocyte transformation in 10 out of 15 patients with suspected halothane hepatitis, and claimed that this test was helpful in the differential diagnosis of viral and halothane hepatitis. We have evaluated this test in the diagnosis of halothane hepatitis.

Patients, Methods, and Results

Seventeen patients with a clinical diagnosis of halothane hepatitis were studied (table). All had developed hepatocellular jaundice within two weeks of halothane anaesthesia. Patients with alcoholism, chronic liver disease, or hepatitis B antigen were excluded. Nine of the 17 patients developed hepatic encephalopathy, and six died. Liver tissue obtained in 14 patients, either at

TABLE—Clinical details and results of lymphocyte transformation test

No.	Age	Sex	Diagnosis or operation	Number of halothane exposures	Tested day*	Clinical condition†	Result
1	41	M	Ischiorectal abscess	3	1	J, C	Negative
2	68	M	Perianal abscess	4	26	J	Negative
3	55	F	Sympathectomy	7	2	J	Negative
4	70	F	Ca. uterus	2	14	J	Negative
5	76	F	Ca. uterus	3	22	J	Negative
6	42	F	Duodenal ulcer	2	3	J, C	Poor cell survival
7	48	F	Cholecystectomy	2	6	J, C	Negative
8	67	F	Ca. breast	2	15	J	Negative
9	60	M	Carotid aneurysm	1	2	J	Negative
10	44	M	Fractured radius	2	4	J, C	Poor cell survival
11	62	M	Hip replacement	1	47	J	Negative
12	52	F	Mastoidectomy	2	6	J	Negative (poor conversion to phytohaemagglutinin)
13	56	F	Retinal detachment	2	13	J	Poor cell survival
14	75	M	Cataracts	2	7	J	Negative
15	70	F	Cataracts	2	33	J	Negative
16	68	F	Meningioma	3	194	R	Negative
17	64	F	Ca. uterus	3	179	R	Negative

*Number of days after the onset of jaundice. †J = jaundiced, C = hepatic coma, R = recovered.

necropsy or during recovery, showed acute hepatitis with varying degrees of necrosis.

The lymphocyte culture method was based on techniques published previously.^{3,4} Leucocyte-rich plasma was diluted with four volumes of Eagle's basal medium containing penicillin and streptomycin. Ten ml was dispensed into three or four 100 ml glass bottles and cultured for six days with 5% carbon dioxide in air. The first bottle acted as a control. Halothane was added to the remainder to give initial concentrations of 5 and 10 or 25 µg/ml. Two ml of the cell suspension was cultured with phytohaemagglutinin and smears examined after three days to demonstrate the ability of the lymphocytes to transform. On the fifth day 0.5 µCi ³H-thymidine was added to each bottle, and the cells were harvested after a further 24 hours. Cells from 0.1 ml of each culture were examined, after staining, for transformation and signs of toxicity. The remainder were washed, hydrolyzed, and then incorporated into a phosphor solution for liquid scintillation counting.

There was no significant difference in radioactivity between halothane and control cultures, and no blast-like cells were seen in smears. In 14 of the 17 patients, cells examined on the sixth day of culture showed no morphological signs of toxicity, but only 13 of the 14 showed a normal lymphoblastic response to phytohaemagglutinin. In the remaining three patients, few viable cells were seen.

Discussion

The techniques used in our laboratory have been successful in detecting cell-mediated immunity to other antigens,⁴ but we have been unable to show this in patients with suspected halothane hepatitis. Patients with jaundice due to other identifiable causes were excluded.

Widely different initial halothane concentrations were employed to find the optimum level for any lymphocyte stimulation. Preliminary tests in which lymphocytes were cultured in the presence of both halothane and phytohaemagglutinin had shown suppression of transformation at initial halothane concentrations of 50 µg/ml or more. Halothane concentrations may have fallen with time, but the odour of halothane was still detectable on the sixth day of culture. Cells from three of our patients did not survive in culture. Two of the three were in hepatic coma, but viable cultures were obtained from two others who were just as ill.

The techniques used by Paronetto and Popper differ in some respects from ours, but the selection of patients appears similar. Two of the patients found positive by Paronetto and Popper were retested later by them and found negative. Walton *et al.*⁵ were unable to show lymphocyte transformation to halothane in 15 suspected halothane sensitive subjects, but only four were jaundiced when tested.

In conclusion, we have been unable to show lymphocyte transformation to halothane in patients suspected of halothane sensitivity, and have found this test of no value in the diagnosis of halothane hepatitis.

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Improved Method for Aspiration of the Pleural Cavity

The conventional method of aspiration of the pleural cavity using either a wide bore disposable needle or a rigid trocar and cannula may be frustrating and carries a definite risk to the patient. Complete aspiration is rarely possible in spite of careful placement of the needle because the residual fluid level lies below the puncture site. Attempts to overcome this deficiency by changing the position of either the needle or the patient carries the risk of damage to the lung and the use of a puncture site below the level of the eighth interspace in the posterior axillary line may result in the needle traversing the diaphragm and passing into either the liver or the spleen.

A safe and efficient alternative method involves the use of a 12-14 gauge radiopaque E-Z CATH intravenous placement unit (figure). The main advantage of this type of catheter over other similar types is that the needle lies within the cannula attached to a stainless steel stylette and can be completely withdrawn once the cannula is introduced. Another advantage is that the cannula remains encased in a soft polyethylene bag which facilitates sterile manipulation.

Application

The patient is seated upright with arms folded and leaning forward on to a bed table. An appropriate rib space is chosen after study of the posteroanterior and lateral radiographs and the puncture site infiltrated with local anaesthetic down to the pleura. The needle and cannula are introduced until arrival in the pleural cavity is indicated by the appearance of aspirate in the transparent catheter. The stylette and needle are then withdrawn about 4 in. (10 cm) and an assistant kinks the cannula between forefinger and thumb before their complete withdrawal. A 60-ml syringe with a three-way tap fitting is then attached to the Luer fitting on the end of the cannula and aspiration started in the normal way.

When towards the end of the procedure, fluid enters the syringe in a jerky fashion and is more easily withdrawn on expiration the catheter is advanced and further aspiration is then performed. As the catheter is flexible, it is possible in difficult cases to change the patient's position from erect to supine. If the effusion is large and the patient experiences respiratory distress due to too rapid removal, the catheter can be strapped into place and sealed for use at a later date. It is also sometimes useful to position the catheter under x-ray control.

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