Conversion of the Braun Unit a I and perfusor to disposable syringes for continuous intravenous heparin infusion

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Mechanical drive syringe pumps for continuous intravenous heparin infusion have been shown to be simple, reliable, accurate, and reasonably economical in practice (Handley, 1967, 1970). The Braun Unit a I infusion pump was found to possess these advantages but the cost of replacing the very expensive Braun ground-glass syringes was prohibitive, and was due to breakage in heat sterilization, in handling, or as a result of incorrect adjustment of the pump limit switch mechanism so that forward movement of the syringe plunger was not automatically arrested before the syringe emptied and the plunger overdrove the barrel. In some of the syringes, wear, accelerated by the sterilization procedures, caused back leakage of heparin between the barrel and its plunger and hence loss of the prescribed dose.

The Braun perfusors were also found to have the same advantages as the more expensive Unit a I pumps, but sterilization of the glass syringes for the machine proved to be difficult because of the rubber gasket on the syringe plunger. Both machines were therefore adapted to the use of disposable plastic syringes.

Materials and Methods

THE BRAUN UNIT a I

Metal clamps marked a and b were made and fitted to the fixed and movable arms of the pump respectively. The jaws of clamp a were held by a knurled screw, marked h on Figure 2. The body of this clamp was drilled so that it would just take the nozzle of a disposable BD Plastipak 50 ml syringe.

Clamp b was attached to the movable arm of the pump by similar means and carried the guard rod of a movable syringe end plate, c, through a square hole mounting which could be locked by a knurled screw nut g. The syringe end plate, c, consisted of a small forward plate, j, and a larger rear plate, k, bolted together rigidly, but between which was just enough space to take the flange of the syringe end

plate. The small forward plate, j, was also slotted to take one of the vertical flutings of the syringe plunger. By these means, the syringe plunger was held rigidly in the mount. A fixed rest, d, for the end

Fig. 1 Structural modification of Braun Unit a I for the use of BD-plastipak disposable syringes showing attachment of clamps b and c.

Fig. 2 End on view of Braun Unit a I showing attachment of clamp a.

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	Braun Unita I with Pump Setting Green at 10 and Delivery Volume (ml/hr)		Braun Perfusor with Pump Setting 3 and Delivery Volume (ml/hr)	
	Using One Syringe Six Times	Using Six Similar Syringes	Using One Syringe Six Times	Using Six Similar Syringes
1	2.33	2.24	2.55	2.55
2	2.22	2.26	2.61	2.63
3	2.24	2.13	2.60	2.67
4	2.30	2.33	2.64	2.51
5	2.21	2.24	2.54	2.61
6	2.25	2.20	2.56	2.64
Average volume (ml)	2.26	2.27	2.58	2.60
Standard deviation (ml)	0.05	0.08	0.04	0.06
Coefficient of variation (%)	2.25	3.5	1.55	2.31
Volume with Braun glass syringe (ml)	2.00	2.00	3.00	3.00
Constant error of disposable syringe (ml)	+0.26	+0.27	0.42	0.40
Constant error (%)	+13	+14	-14	-13

Table Results using disposable syringes with Braun Unita I

of the syringe barrel was bolted to the pump's housing at l.

THE BRAUN PERFUSOR

The perfusor required no structural modifications to adapt it to using 50 ml BD Plastipak disposable syringes and the latter were merely taped down to the syringe mountings by $\frac{1}{2}$ in. adhesive tape.

The rates of delivery of both machines using the disposable syringes were determined at a suitable pump setting by collecting the volumes of water expelled from the syringes in a fixed time via a butterfly drop needle, into a plastic beaker of known tare, and converting the weighed fluid into millilitres.

The results are shown in the Table.

Comment

A rate of about 2 to 3 ml per hour was chosen for the intravenous infusion of heparin as this was best suited to clinical needs. A more rapid rate would have required reloading the syringe too frequently

and a slower rate would have required the heparin concentration to have been increased to a degree that would have been difficult to administer accurately.

The reproducibility of both machines and of the Plastipak syringe was excellent and the deviation in volume delivery of the Plastipak 50 ml syringe compared with the maker's own glass syringes, at the selected pump settings, was acceptable. Due allowance could easily be made for this difference in making up the required heparin dilution.

The administration of heparin and control of dosage by these pumps has been simple and predictable provided that the resident medical and nursing staff are trained to change the syringes twice daily and before the pump limit switch mechanism is activated. There has been no problem of syringe leakage by this method and the 50 ml BD Plastipak disposable syringes are relatively inexpensive.

References

- Handley, A. J. (1967). Heparin administration by continuous infusion pump. *Brit. med. J.*, 2, 482-484.
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