EVALUATION OF THE ERGONOMY AND RELIABILITY OF FOUR INFUSERS

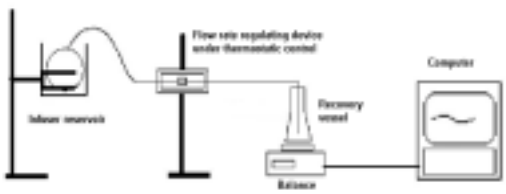
S. Maier, H. Ing, M. Ackermann, P. Bonnabry
Pharmacy, University Hospitals of Geneva (HUG), Switzerland.

Background and objectives

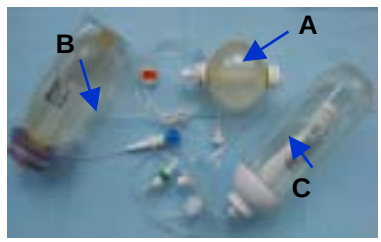
Disposable elastomeric and mechanical (spring mechanism) infusers with pre-fixed flow rates came on the market about ten years ago. They are principally used for long term antibiotherapy, chemotherapy, antiviral therapy and chronic pain management.
The HUG pharmacy prepares approximately 850 infusers per year. The incident level in 2003 was 1 - 5% depending on the model used; 53% due to leakage, 35% to significantly different flow rates to those indicated by the manufacturer and 12% to an absence of infusion.
The objective of this study was to examine the ergonomy and reliability of different elastomeric and mechanical infuser pumps and to determine whether their use is appropriate for the treatment indicated by the manufacturers.

Methods

Four infuser models were tested. Elastomeric: (A) Easypump® B/Braun, (B) Infusor® Baxter and (C) Accufuser® Theramed. Mechanical: (D) Ultraflow® Fresenius Kabi
The ergonomy was assessed using specific questionnaires elaborated for the pharmaceutical staff, nurses and patients. The questions included identification, comfort, ease of handling and filling facility. The influence of several factors on the flow rate reliability was mesured in our laboratory.



Determination of flow rate by weighing



Results

The ideal infusor should be small, light, discrete, easy to fill, and well identified. None of the model fulfilled all of these criteria. The model prefered by patients (Fig.1) and nurses was Easypump® , whereas Easypump® and Infusor® where scored equally by the pharmacy staff.
The average infusion time for 24 hours infusers was 20 hours for Easypump® and Infusor® and 17 hours for Accufuser® (Fig.2). The initial flow rate was higher than the nominal rate (Table.1). The Ultraflow® flow rate remained constant throughout the infusion.
Several parameters influenced the flow rate: flow regulator (Infusor® 95-109%; Accufuser® 90-107%; Easypump® 94-118%; Ultraflow® 91-120%; n=10) (Fig.3), temperature (1%/C for Infusor® ; 1.6%/C for Easypump® , Accufuser®, Ultraflow®) (Fig.4), and difference in height (2% increase every 10 cm).

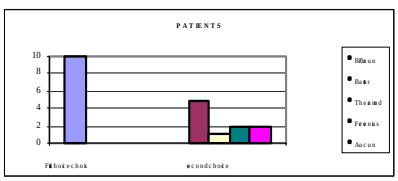


Fig.1- Patient preference concerning the ergonomical factors

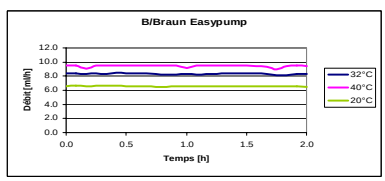
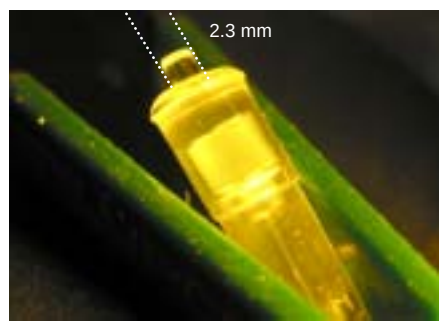
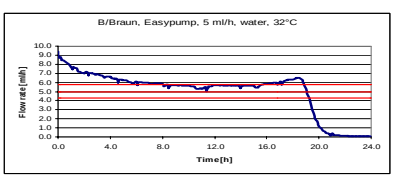
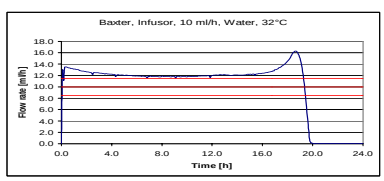


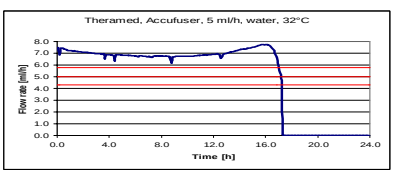
Fig.4 - Influence of temperature on flow rate



Regulating device







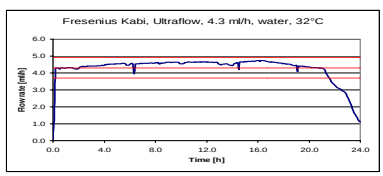
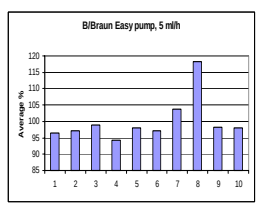
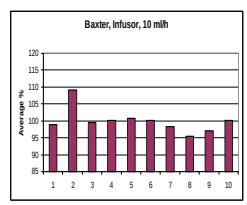
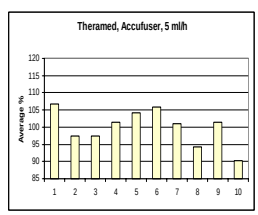


Fig.2- Flow rate reliability under infusion conditions







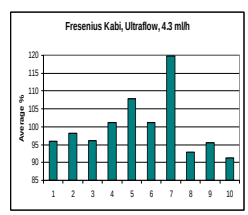


Fig.3-Variability of flow regulating device

Table.1- Infusion time and mean flow rate of 24 hours infusers

	Easypump® 5 ml/h	Infusor® 10 ml/h	Accufuser® 5 ml/h	Ultraflow® 4.3 ml/h
Infusion time [h]	20.5	18.4	17.3	21.6
Mean Flow rate [ml/h]	5.7	12.8	7.0	4.7

Conclusions

Only Ultraflow® presented a stable flow rate, but its ergonomy was very poor. Easypump®, Infusor® and Accufuser® had lower infusion durations than those indicated by the manufacturers and numerous parameters influenced their flow rate, making them inadequate for treatment requiring a stable administration rate (e.g. opioids).

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The infusers used for the experiments were kindly offered by the manufacturers