Designing a simple help card for use with a syringe driver

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This paper describes how a small, simple-to-use, help card was developed for use with a Graseby MS16A syringe driver that can be used with a variety of sizes and manufacturers’ syringes. Also described are ways in which it may help to reduce the chance of accidental error when setting up and monitoring the delivery of 24-hour subcutaneous infusions for pain and symptom control.

Identifying key factors that affect patient safety is at the heart of any good risk-assessment strategy. While the majority of drug treatment in the UK is provided safely, regrettable mistakes do occur. All acute hospitals should establish safe systems that include risk strategies, including appropriate training, to address key issues surrounding the safe administration of medicines. Lessons should be learnt from clinical incidents, accidents and errors, and reflected in training plans to promote a culture of safety (National Patient Safety Agency, 2005; Department of Health, 2004).

Background

Accurate delivery of drugs is essential for maintaining therapeutic efficacy and to this end a range of infusion devices are available. Accurate, low-flow-rate, small-volume infusions can be controlled by means of a syringe pump or syringe driver with an extension line and a range of disposable syringes. Although standards exist for single-use, luer-lock disposable syringes there is a disparity in their physical dimensions and this is unlikely to be resolved in the near future (British Standards Institute, 1997).

As a result, the risk of drug infusion error may be increased if one manufacturer’s syringe is fitted to a device programmed or set up for another. Syringe pumps give rise to the most significant problems in terms of morbidity and mortality (Medical Devices Agency, 2003) and human error continues to be the main identifiable cause (Medicines and Healthcare products Regulatory Agency, 2004). The Graseby MS16A and MS26 ambulatory syringe drivers, which are significantly different in operation, are in common use throughout the NHS. The initial design is more than 20 years old and has very few of the safety features common to modern syringe pumps. Despite warnings from the DH and Graseby Medical, serious clinical incidents, infusion errors and patient deaths have been reported when users have unwittingly confused the two types of syringe driver that are available (MDA, 1995).

While the risk of infusion errors can be reduced by using manufacturer-specific syringes, the Graseby MS16A syringe driver is a non-dedicated device that offers a cost-effective alternative to NHS trusts and other healthcare organisations wishing to purchase syringes from a number of sources. They can be used with any manufacturer’s syringe and were originally indicated for use with intravenous, intramuscular and subcutaneous infusions, using up to 35ml syringes. However, due to the risk of confusion between the two types and safety limitations, the Swansea NHS Trust has standardised to the MS16A and limited its use to subcutaneous infusions.

The MS16A and MS26 syringe drivers are principally distance-operated devices. The infusion accuracy relies solely on the user drawing up the drugs to a known length (in millimetres) and measuring the length remaining in the syringe.

Aim and purpose

Feedback from nursing staff attending a trust-wide study day raised concern over the measurement technique used to draw up the initial and subsequent infusions. Confusion seems to have arisen due to techniques used by staff who are familiar with both the BD Plastipak and Monoject 10ml, 20ml and 30ml syringes. As these differ in their dimensions, this can lead to approximation errors depending on the syringe being used (Table 1, p32). Users were calculating the remaining volume (in millilitres) versus the infusion rate (in millimetres per hour) and an estimate of the actual delivery performance was being made.

A project was therefore undertaken that aimed to:

- Standardise practice to one method of measurement to help staff calculate more accurately the delivery performance of each infusion.
- Design and develop a tool to assist staff in setting up and monitoring these infusions.

Investigating the problem

A trust-wide, confidential database of clinical incidents was searched and 25 infusion errors were identified for the Graseby MS16A between February...
1998 and May 2005. After extensive testing no faults could be found in the majority of these incidents (n=17). Unfortunately, this syringe driver does not have a memory of events and alarms that may have proven useful in the investigations. Nevertheless, two errors were attributed to incorrect rate and incorrect measurement technique used.

All staff attending the syringe driver study day were asked how the MS16A syringe driver should be tested prior to use. None of the staff (n=180) was fully aware of the self-test procedure that is clearly listed in the user manual and printed on the instructions label on the syringe driver.

A small plastic ruler designed by Graseby Medical can be used to measure and record delivery performance and also acts as a rate-adjusted tool for resetting the dials. However, these are not generally available within the trust and carry only a 60mm scale and no other useful information.

The MS16A already has a ruler scale printed on the front panel label. This should be used to measure and draw up the syringe to an appropriate length for each infusion (for example 48mm at 2mm per hour for a 24-hour infusion). Removing the syringe from the driver to re-measure, during the infusion, should be discouraged as this can lead to accidental syphonage of the drug and a potential for mechanical delay. A gap between the case and the finger grips of the syringe, and a gap between the syringe and the actuator can cause a delay of up to two hours if this is left unchecked. This gap is initially reduced when setting up the driver by pushing the syringe tightly against the case and securing with the rubber strap.

**Method**

Four help cards were designed using Microsoft Word with different coloured measurement scales and samples made available to a small group of staff for feedback. The majority of staff (seven out of 12) preferred the yellow background with black lines for the measurement scale.

The colour blue was chosen for the front of the card because it was as close as possible to the blue front panel of the MS16A. It was thought that this would avoid any confusion between this and the green-coloured MS26 syringe driver.

Other important factors derived from DH safety warnings, Medical Devices Agency guidance, clinical incident reports and user manuals were also included on the help card (Table 2). The help card was printed in colour, folded and then laminated to help protect it from fluid ingress and make it more robust.

The initial version of the card included a full 60mm ruler scale and table of results calculated at 2mm per hour. However, when a trust-wide standard measurement was adopted a new version of the help card was redesigned measuring only up to 48mm. This also acted as a reminder to fill all syringes to this point. The calculation table was resized and a larger font was made available.

Smiths Medical, which now supplies the MS16A syringe driver, was approached for assistance in manufacturing the cards and a small number were produced for the trust. These are currently being issued to staff within the organisation. The intention is that all staff who use, set up or monitor infusions using the Graseby MS16A should have access to a help card.

**Evaluation**

The trust syringe driver study days were initially used to introduce and issue the help card. All three types of syringe were used during practical set up and clinical scenarios. All syringes were filled to 48mm for a 24-hour infusion and compared. The volume in each syringe at 48mm was recorded and staff were

<table>
<thead>
<tr>
<th>Size and brand of syringe (luer-lock)</th>
<th>Syringe part number/lot number</th>
<th>Draw-up distance</th>
<th>Equivalent draw-up volume at 48mm</th>
<th>Length after priming (1ml line)</th>
<th>Time to end for first 24-hr infusion</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 ml (Monoject)</td>
<td>110 612173</td>
<td>48mm</td>
<td>9.2ml</td>
<td>43mm</td>
<td>21½ hours</td>
</tr>
<tr>
<td>10 ml (BD Plastipak)</td>
<td>300912</td>
<td>48mm</td>
<td>7.8ml</td>
<td>42mm</td>
<td>21 hours</td>
</tr>
<tr>
<td>10 ml (B. Braun)</td>
<td>4617100</td>
<td>48mm</td>
<td>9.7ml</td>
<td>43mm</td>
<td>21½ hours</td>
</tr>
<tr>
<td>20 ml (Monoject)</td>
<td>1100 620036</td>
<td>48mm</td>
<td>15ml</td>
<td>45mm</td>
<td>22½ hours</td>
</tr>
<tr>
<td>20 ml (BD Plastipak)</td>
<td>7502012</td>
<td>48mm</td>
<td>13.7ml</td>
<td>45mm</td>
<td>22½ hours</td>
</tr>
<tr>
<td>20 ml (B. Braun)</td>
<td>4617207V</td>
<td>48mm</td>
<td>15.2ml</td>
<td>44mm</td>
<td>22½ hours</td>
</tr>
<tr>
<td>30 ml (Monoject)</td>
<td>1100 635430</td>
<td>48mm</td>
<td>20.8ml</td>
<td>45.5mm</td>
<td>22½ hours</td>
</tr>
<tr>
<td>30 ml (BD Plastipak)</td>
<td>3154846</td>
<td>48mm</td>
<td>17.7ml</td>
<td>45mm</td>
<td>22½ hours</td>
</tr>
<tr>
<td>30 ml (B. Braun)</td>
<td>4617304F</td>
<td>48mm</td>
<td>18.3ml</td>
<td>45mm</td>
<td>22½ hours</td>
</tr>
</tbody>
</table>
asked to estimate the amount of drug remaining after four hours. Confusion, identified by staff before introduction of the help card, had been eliminated.

All syringes used on the MS16A syringe driver for a 24-hour infusion are now filled to a distance of 48mm. The MS16A syringe driver is then set to the appropriate rate for the prescription (2mm per hour for a 24-hour infusion).

Each new line is primed and then the syringe is remeasured. This helps in estimating the completion time and in planning patient observation and home visits accordingly.

Regular observation made at ward level can also be made using the help card. The distance remaining is recorded (in millimetres) and this is used to check delivery performance and calculate time for the infusion to complete.

**Discussion**

The MS16A help card has proved useful to staff involved in the safe use, set-up and monitoring of patients on subcutaneous infusions in the Swansea NHS Trust. The card is particularly valuable in endorsing a ‘draw-up-distance’ standard for all healthcare professionals. The 48mm standard is now being written into trust-wide policies and patient monitoring forms are being redesigned in order to include the appropriate measurement scale as a standard.

The priming volumes for shorter lines will affect the completion time for each new infusion. The tests carried out (Table 1) assumed a priming volume of approximately 1ml, whereas in clinical use this can vary significantly depending on the type of line being used.

There are limitations to the use of this card. In particular it is specifically designed for the Graseby MS16A syringe driver. Furthermore, the calculation table is only relevant for 24-hour infusions. For infusion regimes over four, eight and 12 hours the measurement scale can still be used although the calculation table will not be suitable. Additional help cards have now been designed for other infusion regimes and are also available for the Graseby MS26 syringe driver.

With the advent of the Graseby Lock Box (part number 0105-0640) this may need to be opened to gain access to the syringe at each monitoring interval. As a result more security keys will be required. However, estimates can still be made through the clear plastic window on the top of the lock box itself.

A smaller card would have been preferred, namely credit-card size. Unfortunately, the font size (7 points) currently used on the calculation table cannot be increased without affecting the size of the rest of the card. The card is currently too large to fit into the credit card slot within most purses and wallets but fits snugly into shirt and uniform pockets. The latest help card is more robust and has a small hole punched in one corner to allow fitting to a key-ring fob, although it is too early to judge whether this is a suitable long-term solution.

As the help card was initially designed using Microsoft Word, transferring the document between printers and other computer systems can cause an error in resizing and reprinting. Each card must be quality assurance checked for size and should not be scanned or photocopied as this can cause a slight increase in scaling, which will affect the accuracy. Copying may also affect the colour shading.

**Conclusions**

Effective use and monitoring of infusion devices plays an important part in training and education. While it is generally accepted that mistakes will occur, safe systems should be established to identify and reduce risks (DH, 2004).

Nevertheless, the disparity in syringe sizes despite an international standard raises some concern. The continued existence of syringe pumps and drivers that accept a variety of manufacturers’ disposable syringes still presents a series of risks that need to be safely managed.

Standardising measurement technique has been aided with the advent of the help card. Nursing staff, medical equipment trainers and infusion device committees in other healthcare organisations should be made aware of its existence and availability, although it should be pointed out that copyright issues still apply.