DHB NZ Safe & Quality Use of Medicines Group
Position Statement on Intravenous Infusion Practices
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Background

Intravenous (IV) therapy is a complex process usually requiring the preparation of the medicine in clinical areas before administration to the patient, and frequently including the use of an infusion device.[1] Up to 90% of patients admitted to hospital receive IV therapy.[2] Intravenous medication errors have led to considerable patient harm with many of the most serious medication errors in hospital patients being attributed to hypertonic solutions or injectable medicinal products with narrow therapeutic ranges. [3, 4] These errors are also the least likely to be intercepted. [5]

Within the USA, Smart Pump (dose error reduction systems) technology use is widespread. Smart Pumps are intravenous pumps equipped with software that checks pre-programmed doses against preset limits specific to the drug and the clinical location. The clinician may either override an alert (soft limit) or not be allowed to continue at all (hard limit), depending on preset limits. [6]

Published Studies

Studies have identified errors in preparing and administering intravenous medicines in hospitals of between 13 to 84% [1], however differing definitions and methodologies make interpretation difficult. Seven studies in the UK [7 - 13] suggest that the key problems identified during IV preparation were poor no-touch technique, potential contamination from the environment, complex or multiple manipulations, and inaccuracies during calculation and dose preparation. The key problems identified during IV administration were too rapid administration of bolus doses, lack of patent IV access and dose omissions. Comprehensive risk-assessment has been advocated and is described in the Scottish NHS document "Good practice statement for the preparation of injections in near-patient areas including clinical and home environments". [14]

There is limited UK research into the problems associated with infusion rate errors. [15] In May 2004, the National Patient Safety Agency (UK) issued its first safer practice notice about infusion devices, stating that there are 700 incidents reported annually of

unsafe incidents with infusion devices (including 10 deaths) in the NHS. Approximately 19% of these reported incidents were ascribed to user error. The root cause of user error incidents are identified as inadequate staff training and too many different types of infusion equipment with unnecessarily high specifications or multiple configurations and reacting differently under the same circumstances. [16]

Similarly in the USA, since 1985, there have been several hundred reports of incidents involving infusion pumps reported to the FDA and many of these have led to patient deaths. [17] Only one independent prospective study [6] investigated the medication errors associated with IV pumps, concluding that medication errors associated with IV pumps occur frequently, have the potential to cause harm, and are epidemiologically diverse. Specifically, rate deviation errors as a result of programming mistakes were less frequent than expected, while errors associated with orders, documentation, labelling and patient identification were more frequent. The writer concludes that Smart Pumps are a necessary component of a comprehensive safe medication system, but that currently available Smart Pumps will fail to generate meaningful improvements in patient safety until they can be interfaced with other systems such as the electronic patient record, computerised prescriber order entry, bar coded medication administration systems and pharmacy information systems.

Variation or lack of standarisation has emerged as an important issue in medication safety. A recent study [18] comparing the IV best practice data sets of drugs from 100 hospitals concludes that substantial unnecessary variation in IV medication practices is likely associated with an increased risk of harm, and that standardisation has the potential to substantially improve IV medication safety.

International Standards and Directives

ECRI (USA) [19]

ECRI (formerly the Emergency Care Research Institute), a leading technology evaluation organisation, is now rating pumps without dose error reduction software as unacceptable.

Joint Commission on Accreditation of Healthcare Organisation (USA) [20]

In the 2005 National Patient Safety Goals this organisation recommends

- Standardise and limit the number of drug concentrations available in the organisation

National Patient Safety Agency (UK) [16]

The Improving Infusion Device Safer Practice Notice recommends

- Reduce the number of infusion device types in use, and within each type have agreed default configurations
- Investigate the benefits of a centralised equipment library
- Review how purchasing decisions are made

And advises that the NPSA will

- Develop an accredited e learning programme for NHS clinical staff using infusion devices

The Patient Safety Alert Promoting Safer Use of Injectable Preparations [21] recommends

- Undertaking a risk assessment of injectable medicines procedures and products in all clinical areas to identify high risks, and develop an action plan to minimise them
- Ensuring there are up-to-date protocols and procedures for prescribing, preparing and administering injectable medicines in all clinical areas
- Providing training for, and supervision of, all healthcare staff involved in prescribing, administering and monitoring injectable medicines

Clinical Resource and Audit Group of NHS Scotland [14]

The "good practice statement for the preparation of injections in near-patient areas, including clinical and home environments" 2002 contains nine statements of good practice covering prescribing, availability, preparation and administration of injections. Infusion devices are not included in the scope of this document.

2004 Institute for Safe Medication Practices (ISMP) Medication Safety Self Assessment® For Hospitals (USA) [22]

The ISMP is not a standards setting organisation, but produces self assessment tools for use by hospitals as part of ongoing quality improvement activities. The section pertaining to Medication Device Acquisition, Use & Monitoring recommends:

- The types of general purpose infusion pumps used in the hospital are limited to two or less to maximise competence with their use
- The types of syringe pumps used in the hospital are limited to two or less to maximise competency with their use.
- The types of PCA pumps used in the hospital are limited to two or less to maximise competence with their use.
- All electronic infusion control devices undergo inspection and testing at least annually to ensure proper mechanical function.
- All solution administration sets used with infusion pumps have integrated free-flow protection to prevent inadvertent free-flow of solutions if the IV tubing and/or the cassette are removed from the pump.
- Criteria have been established to determine which patient populations, specific medications, and rates of infusion require delivery of solutions via an infusion control pump.
- Practitioner, including agency staff, are educated about medication devices e.g. infusion pumps, automated compounding equipment) and associated protocols/guidelines; and competency with their use is verified before they are permitted to operate a device
- General infusion pumps with Smart Pump Technology are in use with full functionality employed to intercept and prevent wrong dose / wrong infusion rate errors due to misprogramming the pump, miscalculation, or an inaccurately prescribed dose or infusion rate.

Conclusion

In order to minimise the clinical risk associated with the preparation and administration of IV medicines a number of strategies should be implemented:

- Standardise and limit the range of infusion devices taking into consideration specialist areas of practice e.g. neonates and paediatrics
- Develop an education programme for clinical staff who use infusion devices to ensure their competency
- Centralise equipment or establish a central register of equipment
- Ensure that all equipment is inspected and tested at least annually by an accredited biomedical engineer
- Ensure free-flow protection on all infusion pumps
- Introduce Smart Pump technology
- Work towards integration of Smart Pump technology with other IT systems such as the electronic medical record, Computerised Physician Order Entry, bar coded medication administration systems and pharmacy information systems
- Whenever possible use pre-mixed formulations
- Standardise and limit the number of drug concentrations available in the hospital
- Standardisation of administration guidelines and policies for loading and bolus doses
- Develop explicit multi-professional standards for the assembly and preparation of parenteral products in clinical settings
- Ensure that any education programme incorporates the philosophy that technology can not prevent all incidents
- Always trace a tube from the patient to the point of origin before connecting a device or infusion

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