Reflecting on intravenous drug administration: towards safer practice

Neonatal drug administration errors continue to be an escalating problem within NICUs. A strategy to enhance learning and hopefully reduce the number of adverse incidents reported was needed. A literature review was found to be of limited benefit in identifying tools to enable clinical staff to implement risk reduction. A locally developed education programme was successfully implemented resulting in a reduction in the number of intravenous drug administration errors. This article will share the evolution and implementation of this strategy in order to move towards safer practice.

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Keywords

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Key points

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1. Neonatal drug administration errors continue to rise but there is no appropriate educational tool to enable risk reduction.
2. Simulation can provide practical learning opportunities in a controlled secure environment.
3. An IV drug administration programme was implemented, which was well received and reduced the number of infusion errors.

Administration of medication is reportedly the highest risk task a nurse can perform, with accidental errors leading to devastating consequences for both the patient and the nurse's career[1]. Medication errors can be any incident where there has been an error in the following processes regardless of whether any harm occurred or was possible[2]:

- prescribing
- dispensing
- preparing
- administering
- monitoring
- providing medicines advice.

Medication errors have been likened to an iceberg, with only the tip being visible[3]. The National Patient Safety Agency[2] found that almost one in ten inpatients experienced medication-related harm, while Kaushal et al[4] found that potential adverse drug events occurred eight times more frequently on NICUs than in adult populations.

It is difficult to ascertain the number of administration errors in the neonatal unit environment. Much of the literature utilises differing definitions of error; looking particularly at administration errors can prove difficult. Locally there appears to be a perceived increase in medication errors, which could be due to the increasing workload of nursing staff; however this could also be due to a more robust incident reporting system. Nevertheless what is apparent is the cost, both financial and human, to patients and staff. Taken together with what is known of litigation costs, it is estimated that preventable harm from medicines costs more than £750 million each year in England[2]. Neonates are extremely vulnerable to medication errors due to their increased exposure to highly complex medications on the NICU. The effect on staff confidence and morale can be devastating following a medication error. It has been suggested that in a highly stressed neonatal environment, preventable errors could be one of the factors that cause nurses to leave the profession[5].

In seeking to devise an educational strategy to help reduce drug administration errors it was important to acknowledge the education neonatal nurses receive during their training. The Nursing and Midwifery Council (NMC) competencies for entry to the register were reviewed. Specific guidance relating to drug administration requests that: "All nurses must practise safely by being aware of the correct use, limitations and hazards of common interventions including the calculation and administration of medicines and the use of medical devices and equipment"[6]. The Royal College of Nursing (RCN) guidance on competencies in neonatal nursing was also reviewed. This guidance was developed in order to standardise training provided through higher education institutions to ensure practitioners who develop 'qualified in specialty' (QIS) status have the same knowledge and skills. Pertaining to the practice of drug administration, the document recommends that students are able to: "Demonstrate safe administration of relevant drugs in all situations, in

accordance with professional policies, and the ability to assess and evaluate responses"[7]. From personal reflection and enquiry with nurses working on the neonatal unit, it would appear that although significant education is provided during pre-registration nurse training on drug administration, the emphasis on neonatal-specific drugs and calculations seems to be minimal. Of those who have since developed QIS status, many have learnt the skills necessary to administer complex drugs in the clinical area. The question is whether this is enough to prevent administration errors in the clinical area.

Background

A training need was identified following a meeting regarding a number of serious infusion errors on the NICU. In the preceding 12-month period there had been 21 reported incidents. These included all aspects of drug prescribing and administration. To address these needs the development of a non-threatening educational programme was deemed necessary. It was anticipated that in developing such a programme, staff confidence and morale would increase and the number of adverse drug errors would decline.

Literature review

A search was implemented using the following keywords:

- drug administration
- continuous intravenous (IV) drug administration
- neonatal, newborn, infant, medication errors
- prevention and control
- nursing education programmes.

The CINAHL, Embase, Medline and PubMed databases were utilised and the search was restricted to articles from 2003-2013. Only original studies published in English were accepted.

The authors were seeking to obtain high quality evidence of a successful educational strategy to reduce medication administration errors on the NICU, yet the search provided guidance limited to practice-based articles with a primary focus on paediatrics (as opposed to neonatal nursing) and prescribing (as opposed to administration errors).

It has been found that three quarters of neonatal medication errors occurred at the prescribing stage[4]. Much of the literature focusing on strategies to improve medication safety revolves around ways to reduce these prescribing errors, such as computerised provider order entry (CPOE), ward-based pharmacists and bar coding[5,8].

Some of the literature offers explanations for administration errors, however there appears to be no identified solution to these issues. One study found that nearly one third of IV drug prescriptions on a neonatal unit were for doses that were less than one tenth of a single drug vial[9]. Ten-fold drug errors in prescribing are well documented and as such, there is great potential for serious administration errors. Furthermore, one in 20 of those doses was for less than one hundredth of a vial. A systematic review on the occurrence of errors in the preparation and administration of IV medication indicated that two stages of IV therapy had the greatest error probability; the reconstitution of the drug and diluent, and the administration of the drug[10]. These findings are confirmed as being the most vulnerable stages in the medicine administration process in another study[11].

Many of the available recommendations have already been implemented as good practice within the local neonatal unit including the double checking of medication[12], ward-based pharmacists and access to appropriate formularies[5,8]. It was identified that there was no specific area for drug preparation, which has now been rectified. Many of the recommendations within the literature focused on the need for continued education. In 2000 the Department of Health report, Organisation with a Memory[13], highlighted the need for reporting adverse events and ongoing investigation. Since then there have been numerous reports that have highlighted medication errors as an area for concern. However, there appear to be no dependable tools to enable clinical staff to implement risk reduction.

Medicine errors are unavoidable but they can be minimised by regular staff training[14]. Educational programmes in all aspects of medicine preparation and administration are recommended[15]. This could include opportunities for discussion away from the clinical environment, which might help to reduce the number of clinical incidents. The RCN competencies document suggested that the majority of human error could be minimised with the introduction of two main strategies: basic training complemented by regular updating on an annual basis and incident reporting within a culture of safety[16].

The available literature does not offer practical steps towards ensuring safe practice in administering medicines within the field of neonatology. When reviewing how best to implement the teaching of relevant practical skills, much of the work is embedded in Kolb's teaching theory on experiential learning[17]. It is now seen as an important domain in adult educational programmes where the aims are focused on the acquisition of practical skills.

One technique that is based on this strategy is that of simulation-based learning. Simulation can provide practical learning opportunities in a controlled secure environment. The idea of clinical simulation has been around since the 1980s[18]; historically it has been used to teach psychomotor skills such as injections and catheterisation. It ensures that a safe learning environment is provided in which learners respond to a predetermined clinical situation. However, the role of clinical simulation in the ever-changing healthcare system is adapting to meet required cognitive and affective skills, such as clinical judgement and decision making.

Safe drug administration is an ideal concept to incorporate into a simulated working environment. It is often seen as a basic nursing task when in fact it requires complex interaction of a large number of specific dimensions and actions, utilising appropriate clinical judgement skills as well as effective team working abilities. When coupled with the intensity of the clinical setting in the neonatal intensive care area, it is understandable how mistakes can occur.

By offering simulated clinical scenarios in a controlled, safe environment it is proposed that an upsurge in an individual's self confidence will ensue[19]. This is of vital importance as it has been suggested that if nurses lack confidence there is a high risk of errors[15].

Responding to need

In the absence of a suitable educational tool, a locally developed educational programme was devised. The programme needed to be a holistic package that would cover the complete journey from prescription accuracy, dispensing, preparation and ultimately administration of the correct drug to the correct patient. The journey was broken down into specific

Identify personal and professional accountability in the administration of IV therapy in relation to the NMC professional code of conduct
Discuss the principles of asepsis in IV therapy
Demonstrate the safe preparation of IV drugs
Be able to identify hazards associated with IV therapy and the administration of IV drugs
Demonstrate the accurate calculation of drug dosage
Demonstrate the accurate preparation of a continuous drug infusion

TABLE 1 Learning outcomes for the education programme.

learning outcomes (**TABLE 1**), which formed the basis for the objectives and the educational tool.

This programme was aimed at the QIS members of the neonatal team, irrespective of their seniority and years in service. It was appreciated that this would generate apprehension and significant stress to those involved.

To begin the process there were informal discussions within the multidisciplinary team. A pre-course learning package was drafted, which was evaluated at a focus group that included senior neonatal nurses. Adjustments were made following successful feedback. The pre-course workbook included a chapter on each aspect of the identified learning outcomes and was designed to reaffirm skills and knowledge already utilised in the clinical setting. This was intended to allay apprehension surrounding the workshop scenarios. The workbook helped the participants to identify the learning outcomes prior to the session, as well as giving a wealth of information pertaining to relevant issues surrounding IV administration. When the workbooks were launched each nurse candidate was allocated a mentor for support during the process.

A set of four skill stations were formulated that addressed issues particularly pertinent to the neonatal unit at the time. The drugs used in these skill station scenarios were:

1. Adrenaline infusion
2. Double strength dobutamine infusion
3. Vancomycin infusion
4. Bolus dose hydrocortisone.

These drugs were chosen due to the high risk of potential error associated with their preparation and administration. Development of these critical thinking skills would be transferable to other drugs and their administration.

The skill station scenarios were facilitated within the education centre away from the neonatal unit. This ensured a controlled environment and enabled the candidates to focus entirely on the scenarios rather than clinical responsibilities. The unit manager supported this and ensured that these hours were included within the nurses' working hours.

The workshop commenced with a presentation by the neonatal unit pharmacist and course facilitator. This consolidated the theoretical component by reviewing the contents of the workbook and answering any unresolved questions.

Two members of the focus group facilitated each skill station, which comprised an everyday task starting with the IV prescription and ending with the administration of the drug. All of the stations had the necessary resources to complete each scenario thoroughly, including relevant drug information and the appropriate infusion pumps to ensure that the device was set accurately to administer the drug. Candidates were allocated to work in pairs therefore mimicking the real life clinical environment. Throughout the workshop the candidates visited all four skill stations; there was an expectation that candidates would discuss and demonstrate each step of the process. Each skill station was assessed using the competency document. This contained five broad areas which required consideration and review:

1. Checking prescription accuracy
2. Utilisation of available resources
3. Calculation of the prescription
4. Practical dilution of the drug
5. Preparation and completion of the drug infusion label.

No time limit was set although 30 minutes was allocated to each skill station; this was found to be more than adequate in most cases. The course facilitator was always on hand to step in if a candidate needed additional support during the workshop. If an issue arose that could not be resolved at the time, the candidate could work with their mentor to clarify the problem then work through the issues identified, ultimately ensuring the competencies were safely achieved.

Following the successful completion of the workshop, candidates received a certificate to add to their portfolio.

Evaluation

As this educational tool was newly devised, evaluation was of high importance. A pre- and post-workshop evaluation form was used. The evaluation tool utilised the Likert scale to assess a candidate's feelings around the skill station workshop.

It appeared that candidates had limited training on IV drug administration to neonates prior to the workshop. Many lacked confidence when both preparing and calculating IV infusions for administration. Following the skill station scenarios over 90% of candidates felt that their confidence in dealing with the preparation and calculation of IV infusions had increased. Six months after the skill station scenarios, a further evaluation was conducted, to which there was an 88% response rate. Ninety per cent of those who responded still felt that they were confident in the preparation and calculation of IV infusions for administration to neonates.

Moreover following completion of the programme, it was essential to review the effect on the number of clinical incidents reported surrounding IV infusion administration. In liaising with the ward-based pharmacist it was found that no infusion errors had been reported in the ensuing nine months. There had been seven drug-related errors, all of which were connected to oral drugs rather than IV drugs.

Discussion

There was a great learning curve for everyone involved in the workshop scenarios. Upon discussion with senior members of the nursing team, who attended the workshop as candidates, a range of anxieties was evoked. However, upon reflection, the benefit to clinical practice was acknowledged and as more candidates successfully completed the scenarios these levels of anxiety appeared to diminish as positive feedback from their colleagues emerged.

Initially the course facilitator thought

that this was going to be a short and simple task. However, the workbook grew into a workshop scenario session which then grew into ongoing annual sessions. It has also been incorporated into curriculums within local higher education institutions and training programmes at a network level. In hindsight, the project was much larger than initially anticipated, the time required to set up such a programme was under estimated. In the future any further projects should have a realistic time allotted to them.

Although this initial pilot project was developed for QIS staff with specific IV drugs pertaining to the intensive care unit, there has since been a workshop developed for non-QIS staff, which follows the same format but utilises common bolus IV drugs that these nurses are expected to administer on a daily basis. This will aid their continuing professional development and has now been recommended and accepted as part of the training culture on the unit, such that the sessions will become part of the annual mandatory training. This has received support from the management team on the unit, as there is now evidence that this educational approach has resulted in a significant reduction in the number of administration errors.

To effectively evaluate the impact of implementing such an educational strategy the authors acknowledge the importance of a robust mechanism for reporting administration errors. This plays a pivotal role in improving the medication management process. Education about a nurse's legal and moral obligation to report such incidences needs to be reiterated to ensure that units capture true data. There is a need to ensure that a culture of safety is fostered in which there is a shift in focus from counting the number of errors to a more proactive approach – developing a preventable strategy. It is anticipated that more transparency in terms of reporting will be attained if nurses understand that the information will help to underpin future development of such educational strategies. This will help prevent further errors and help us as a profession to learn from common errors identified. It is recommended that health professionals work together from a network perspective to capture true clinical data pertaining to drug administration errors and provide support to the multidisciplinary team for such educational strategies. An audit would be beneficial to review the impact on a larger scale on clinical practice.

The NMC states that nurses are: "Accountable for any actions and omissions in [their] practice and must always be able to justify [their] decisions"[20]. The workshop enables the nurse to fulfil aspects of the code with regards to keeping up-to-date and improving knowledge and competency. Nurses have numerous responsibilities when involved in administering IV medications. Not only is it essential to protect themselves from making errors but also to identify and deal with any errors made by the prescriber[21]. It remains a high-risk area for nursing practice and a matter of concern for practitioners, policymakers and families.

Conclusion

In reviewing the literature it was discovered that there is a paucity of evidence of a successful educational strategy to reduce medication administration errors on the NICU. There was no research that identified best practice for ensuring safe administration of IV medications or for dose calculations for nurses. Many of the studies were focused on paediatric populations. It is therefore suggested that further research is undertaken to investigate issues relevant to the neonatal population.

Pressures to reduce the number of risks in the intensive care environment have resulted in the need to ensure a safety conscious culture. Clinical simulation is an ideal approach to embrace this ethos as it allows a risk-free approach to learning. The idea of integrating task orientation and team working skills in an environment that closely replicates the clinical working environment has enhanced performance and has reduced errors.

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