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Original Article

The frequency and importance of reported errors related to parenteral nutrition in a regional paediatric centre☆

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SUMMARY

Aim: To determine the frequency and significance of reported errors related to parenteral nutrition (PN) in a regional paediatric centre.
Methods: In our children's centre, it is policy that "any unexpected event with an actual or potential detrimental effect on a patient is formally reported on an incident report (IR1) form" by staff. We therefore reviewed all IR1 forms related to PN between January'06 and June'09. The errors were categorised according to where in the PN process they occurred. Harm scores (severity of the error in relation to patient safety) were based on the framework of the American 'National Coordinating Council for Medication Error Reporting and Prevention' (NCC MERP).
Results: Over 18,588 PN days, 46 errors were identified, giving an error frequency of 0.24%. Of these, 5 (11%) occurred during the prescription process, 9 (20%) during the transcription process, 11 (24%) during dispensing, 7 (15%) during delivery of PN to the ward and 14 (30%) during the administration process. No errors were reported during the preparation/compounding process. 43 (94%) errors did not result in patient harm, while 3 (6%) errors resulted in temporary harm.
Conclusions: Reported PN related errors resulting in harm appear to be rare. Most occur during dispensing and administration suggesting that more robust checking procedures are required during these phases. The widespread reporting of non harmful errors indicates that staff have an appropriately low threshold for completing IR1 forms; these represent a valuable audit tool for improving patient safety.

1. Introduction

Parenteral nutrition (PN) is widely used for infants and children with intestinal failure from a variety of underlying conditions or in preterm newborns with gastrointestinal immaturity.[1,2] Deficiencies in the care of patients receiving PN, including inadequate documentation, poor monitoring and avoidable complications, have recently been highlighted in a report from the National Confidential Enquiry into Patient Outcome and Death (NCEPOD).[3] The UK National Aseptic Error Reporting Scheme (NAERS) stated that errors with paediatric aseptic preparations including PN appeared to be associated with greater levels of perceived patient harm.[4] Providing safe and effective PN to children is a complex process requiring the formulation of stable, sterile solutions containing a wide variety of ingredients. These have to meet the needs of diverse individual patients, ranging from extremely premature 450 g newborns to 100 kg adolescents with a vast array of associated complicating medical conditions. Guidelines have been published in an attempt to standardise the approach to PN for different age groups[5] and to emphasise safe practice. As with any process in medical care, there is the potential for harmful errors to occur, although there is little available information in the literature regarding the frequency and significance of these errors in children. In our hospital it is a requirement that "any unexpected event with an actual or potential detrimental effect on a patient is formally reported on an incident report (IR1) form" including any related directly to PN. We therefore decided to review all such reports in order to determine the nature, frequency and significance of errors.

Abbreviations: PN, Parenteral nutrition; IR1, Incident form.

☆ NCC MERP – National Coordinating Council for Medication Error Reporting and Prevention Conference presentation: Poster at RCPCH meeting at Warwick 2010 and ESPGHAN meeting at Istanbul 2010, oral presentation at BAPEN 2010.

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2. Methods

Our centre provides secondary general and tertiary specialist paediatric services, including a comprehensive range of specialities for a catchment population of around four million. All PN prescribing is done by an experienced pharmacist with reference to standard protocols[5] and working as part of a multidisciplinary nutritional support team.[6] The amino acid solutions used are "Vamin 18EF" and "Vaminolact"(Fresenius Kabi); the amino acid/glucose solutions are collectively referred to in the text as 'Vamin'.

We retrospectively reviewed an electronic database collated by the risk management team that details all the medication errors reported on IR1 forms based on the clinical area reporting them, e.g. paediatric medicine, paediatric surgery, paediatric intensive care, neonatology, pharmacy aseptics and on call pharmacy, etc. All IR1 forms related to PN between January'06 and June'09 were retrieved from this database and scrutinised in order to determine the frequency and nature of the reported errors. The total PN days were based on all the paediatric and neonatal patients given PN in the hospital during the study period and this information was collected from a database maintained by the pharmacy aseptic unit prospectively.

The reported PN errors were then categorised according to where in the PN process (from prescribing to intravenous delivery) they occurred. We divided this into six stages (Fig. 1) as follows:

1. 'Prescription': the composition of PN as decided and written down by the PN prescriber in consultation with relevant clinical teams.

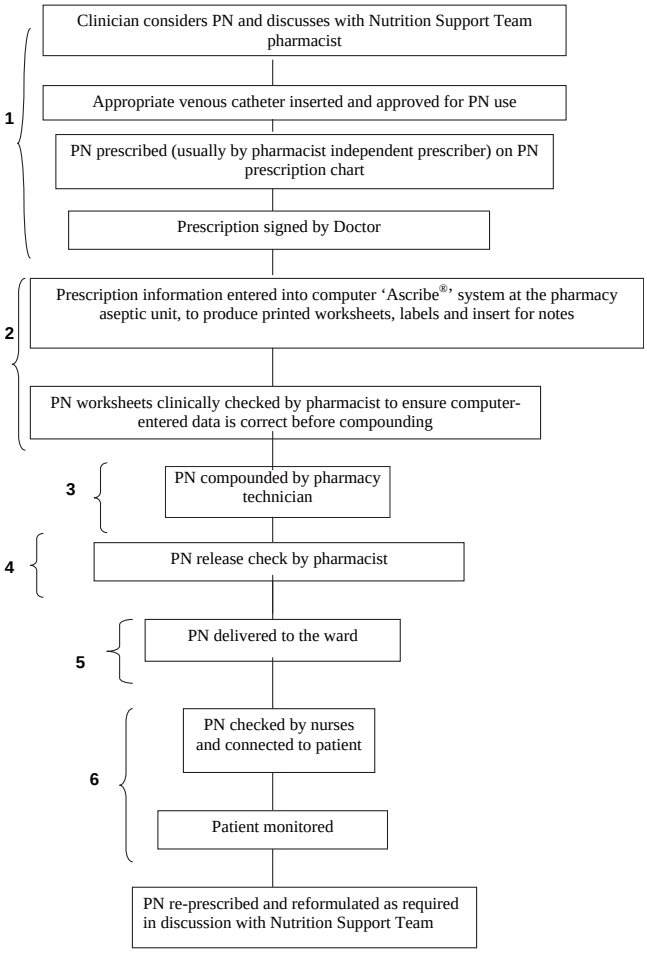

Fig. 1. Pathway illustrating the six stages of the PN process at Leeds Teaching Hospitals.

2. 'Transcription': the process whereby the prescription is converted to a printed work sheet for pharmacy (using the prescribing software called 'Ascribe®'; Ascribe Ltd is a healthcare company that delivers clinical IT systems including modules for pharmacy and PN); this also includes production of a printed copy of the prescription that is sent to the ward for insertion in the patient's notes, the labels for the PN bags, and the work sheet ('recipe' sheet) for the pharmacy technicians to read from when compounding the PN.
3. 'Preparation/compounding': the process during which the Pharmacy Aseptic Unit prepares the PN solution. This requires the mixing of a wide range of ingredients, both macro-solutions (amino acids, glucose, electrolytes and water) and micro-solutions (vitamins and trace elements).
4. 'Dispensing': the final checking procedures, performed by the pharmacist, where the printed paperwork is checked against the original prescription and any deviations annotated on the original prescription. The aqueous bag and lipid bag/syringe are visually examined for particulate matter or creaming, weighed as a safety check to make sure they are within the predicted limits (+or −5%), and all source containers (i.e. ampoules, syringes, vials) re-checked to ensure that the correct ingredients have been used at the right volumes. The final part of dispensing is for the labels to be placed on the aqueous bag and lipid bag/syringe respectively.
5. 'Delivery': this is where the finished product (comprising PN fluids, original prescription, and documentation for filing in the patient notes) is taken from pharmacy to the ward.
6. .'Administration': this happens at the bedside, where nursing staff examine the product and check the documentation against the original PN prescription before the PN is infused into the patient. Nursing staff also check that the route of administration is suitable and that the rates are correctly read from the bag/syringe labels before the infusion pumps are set. After this, there is ongoing clinical and biochemical monitoring of the patient and the PN is then reformulated following discussion with the nutrition support team (Paediatric gastroenterologist, specialist nurse, dietician and pharmacist)

The significance of an error was determined by assigning a 'harm score' (severity of the error in relation to patient safety) based on the framework of the American 'National Coordinating Council for Medication Error Reporting and Prevention' (NCC MERP).[7] Within the NCC MERP index there are four groups for categorising medication errors (Table 1).

3. Results

Over 18,588 PN days, 46 errors were reported on IR1s, giving an error frequency of 0.24%.Of these, 5 (11%) occurred during prescription, 9 (20%) during transcription, 11 (24%) during dispensing, 7 (15%) during delivery and 14 (30%) during administration or monitoring (Table 2). No errors were reported from the preparation/compounding process which is stringently quality controlled in the pharmacy aseptic unit. Fig. 2 shows the severity of errors based on the NCC MERP index classification. Fourteen were category B, i.e. circumstances or events that have the capacity to cause error, but the error did not reach the patient, while 32 errors reached the patient (category C, D and E). Of the total errors, 43/46 (94%) did not result in patient harm (categories B, C, D), while 3/46 (6%) resulted in temporary harm (category E) (Table 3). The 3 errors that resulted in temporary harm included one transcription error where potassium prescribed as 1.5 mmol/kg/day was incorrectly transcribed as 15 mmol/kg/day in a ventilated preterm infant. This error was picked up on a routine blood gas analysis which demonstrated rising potassium levels, prompting checking and