

Caring for the smallest of the small — a career in neonatal pharmacy

By **Maiya Ahmed**, MRPharmS

More premature babies, born at increasingly low gestational ages, are surviving, and so neonatal pharmacy is a rapidly growing area of practice.

This article describes the role of a neonatal pharmacist



Babies born at low gestational ages may need to spend their first few weeks of life in an incubator

Neonatal pharmacy practice is a rapidly developing area. The success of *in vitro* fertilisation has resulted in more multiple births, with premature babies being more likely to be born from such births. Advances in care, including medicines use, mean that babies of increasingly low gestational age are surviving — the survival rate of babies born weighing less than 1kg is currently about 80 per cent, whereas 20 years ago it was 20 per cent.¹

By definition, a neonate is a newborn baby up to the “corrected age” of one month. Corrected age is calculated by subtracting the number of weeks born before 40 weeks of gestation from the chronological age (the time elapsed since birth). This means that there can be four-month old babies on the neonatal unit who are still classed as neonates.

Approximately 12 per cent of births per year result in a baby needing some form of special care, and approximately 2.5 per cent of births will require some form of neonatal intensive care.¹ This article describes the care given to such babies at St Mary’s Hospital, London.

St Mary’s Hospital

St Mary’s Hospital is a tertiary centre for neonatal intensive care. This means it has frequent referrals from hospitals which do not

Maiya Ahmed is neonatal pharmacist at St Mary’s Hospital, London

have either the capacity to treat, or the staff who have the experience of treating, seriously premature babies or babies who have complex problems and need specialist care. The neonatal unit is a 26-bed unit with an intensive care unit (NICU), where severely premature babies, or babies born at term who require intensive care, are looked after. It also has a high dependency unit (HDU) and a special care baby unit (SCBU), where babies who need minimal medical care but who, for example, are having difficulty feeding, are cared for.

Neonatal pharmacy practice

Although there are many similarities between neonates and paediatric patients, there are also some major differences. This means that the pharmaceutical care required can differ between the two groups of patients. For example, the clearance and excretion of drugs is particularly hindered in neonates, and their kidney and liver functions can fluctuate quite frequently. This means that blood levels, particularly trough levels, of certain antibiotics need to be closely monitored in neonates to determine whether the drug is accumulating or being effectively cleared.

Assessing the impact of painful procedures can also be especially difficult in neonates, because the severely premature baby may not have developed the relevant processes or features (for example, a high-pitched scream) that one looks for when assessing paediatric patients. Older children can also

become involved in their own care and treatment, as recommended by the second National Service Framework for Children,² but this is not relevant for neonates (although it will be relevant for their parents).

Methods of drug delivery can also differ. For neonates, the oral route is often inappropriate, and so is the peripheral route, because the friability of neonatal veins means that there is a high risk of extravasation. Instead, single-lumen long central lines are used. Compatibility is therefore a key issue — more than one drug will often be present in the same line and contact times can be long because drugs have to be infused slowly. For paediatric patients, drugs can generally be infused more quickly and double or triple lumen central lines can be used.

Pharmacist’s role

The pharmacist’s role on a neonatal ward is similar to the role of pharmacists on adult and paediatric intensive care wards because his or her patients are particularly vulnerable. The main aspects of the job are as follows:

- Providing a clinical pharmacy service
- Providing input into parenteral nutrition services
- Developing a formulary
- Educating staff and parents
- Being part of a multidisciplinary team
- Providing input into maternity services

Further details of these are described in the rest of this article.

Clinical pharmacy service Advising about drug choice is key to the role of a neonatal pharmacist. When considering medicine use, it is important to bear in mind the gestational age of a baby. As mentioned above, the pharmacokinetics of drugs differ in neonates to other patients and so adjustments of the dose or frequency of dosing, over and above those accounted for by reduced weight, may be necessary. Similarly, skin penetration of drugs is a key issue, with the skin of a neonate being particularly permeable. This means that some creams that are used on paediatric patients cannot be used on neonates. For those that can be used, there is a risk of systemic absorption. For example, if chloramphenicol ointment is used topically on a suture line the likely effects of the dose applied might need to be compared with the likely effects of giving that dose intravenously in order to assess risk. Systemic absorption from eye drops is also an issue in neonates.

Parenteral nutrition Most babies on the neonatal intensive care unit will require parenteral nutrition at some point during their stay. Considerable pharmaceutical input is required, both in terms of the prescribing and manufacture of parenteral nutrition. Factors that need to be considered include:

- Whether the baby has a long line or a peripheral access
- What the electrolyte levels are
- Whether the baby can tolerate lipids — lipids being contraindicated after gut surgery or if the baby has hyper-bilirubinaemia (ie, jaundice), a condition that is fairly common in the newborn baby

Enteral feeds are encouraged and initiated as soon as possible to encourage development of the bowel and gut flora. The amount

Panel 1: Useful sources of neonatal pharmacy information

- Neonatal and Paediatric Pharmacy Group. The group's website (www.nppg.org.uk) includes a messageboard where members can post queries
- British Association of Perinatal Medicine (www.bapm.org)
- The Royal College of Paediatrics and Child Health. (www.rcpch.ac.uk)
- BLISS, the premature baby charity. (www.bliss.org.uk)
- Thames regional perinatal group (www.londonpaediatrics.org.uk/trpg/trpg.htm)

given is slowly titrated up. Increasing feeding too rapidly is associated with necrotising enterocolitis, a condition that is common in neonates and causes necrosis of the gut wall. Hyperglycaemia and hypoglycaemia are both fairly common in neonates, particularly those born to diabetic mothers. These conditions require appropriate changes in the glucose content of the parenteral nutrition, and glucose levels should be monitored regularly in these circumstances. Fluid balance is also particularly important when providing parenteral nutrition (and also intravenous infusions) to neonates. What might seem like a small volume of fluid to give a child or adult patient can have a huge impact on the fluid balance of a neonate.

Education Neonatal pharmacists play a significant role in educating junior doctors. Senior house officers practising in this field will usually be on a six month placement and will have a predominantly paediatric background and may not be aware of the differences between neonatal and paediatric patients. As well as explaining these differences, issues to cover include the importance of prescribing doses that can be given accurately, avoiding common prescribing errors such as prescribing in "mg" and not "ml" and avoiding leading zeros (eg, 0.01mg) by using micrograms.

To educate others, neonatal pharmacists need to keep up with recent developments in their field. Issues often include the availability of new medicines, developments in care and changes to licensing status of drugs. There are also drug dilemmas unique to neonatal medicine that pharmacists need to keep abreast of. For example, recent evidence suggests that giving dexamethasone to premature babies might lead to cerebral palsy,³ but the drug is known to be highly effective in weaning babies from ventilators.⁴

Multidisciplinary team member At St Mary's Hospital, there is a multidisciplinary ward round at the beginning of each week, where each baby's condition, needs and development are discussed in depth. This is attended by neonatal doctors, charge nurses, the neonatal pharmacist and the dietician. Babies' medicines are often reviewed and discussed and so a pharmacist's input is crucial. Following on from this, a registrar-led ward round takes place twice daily and there is a microbiology ward round once weekly, led by the microbiology consultant. The neonatal pharmacist attends these as necessary.

Neonatal pharmacists are also called on to provide information and advice about the use of drugs during breastfeeding. Some medicines may be deemed safe in pregnancy but not in breastfeeding and vice versa. For mothers taking medicines during pregnancy, an advance plan can be made for their postnatal period. At St Mary's Hospital, a

multidisciplinary nutritional group, that has recently been set up, provides a forum to discuss these issues, as well as other issues such as parenteral nutrition and enteral feeding.

A monthly meeting is held by the adult and paediatric HIV teams (including the paediatric HIV pharmacist). The care of HIV-positive mothers who will be giving birth at St Mary's hospital is discussed, as is the rationale to minimise the chance of vertical transmission to their babies. CD₄ count, compliance, drug resistance and viral load are all factors to be considered, as these affect which drugs the baby and mother will receive. A birth plan is drawn up and added to the mother's notes. As neonatal pharmacist, I receive a list of these mothers, their expected date of delivery and the drug regimen suggested in the treatment plan, which I check against the notes of the meeting to identify any unexplained inconsistencies.

Risk management meetings are also held monthly. If an incident has occurred during that month it is discussed at this forum. Using the NHS "no blame culture" mentality, any changes that can be implemented to prevent similar mistakes re-occurring are considered. These might include developing better guidelines and re-educating staff. These improvements are then reassessed in future management meetings.

Formulary development Since starting at St Mary's Hospital, I have taken a major role in putting together a formulary for use on our neonatal unit, which covers all the medicines commonly used, along with guidelines, such as pain protocols and guidance about infusions, parenteral nutrition and immunisations. Producing this document was rewarding and was a great learning experience. The document was checked and re-checked by various groups at the hospital, minimising the chances of errors being missed. This exercise also enabled the opinions of many people to be collated and acted on. We are currently in the process of making the document into a book that can be distributed to nursing, medical and pharmacy staff. The information will also be available widely available at St Mary's Hospital on the intranet, the NICU's computerised notes system and on compact discs which will be distributed among non-NICU staff on request.

Maternity role Being a neonatal pharmacist in many hospital settings will involve having responsibilities not only for neonatal wards, but also for the maternity wards. At St Mary's Hospital, the maternity wards are covered on a daily basis by a junior pharmacist on a three-month rotation. The neonatal pharmacist assists in the training of these pharmacists and is available to answer any queries that may arise. Frequent issues relate to the use of medicines in the third trimester of pregnancy and while breastfeeding. Using

the British National Formulary or BNF for children alone to check these is not usually adequate, and additional reference sources are regularly used, such as the Royal College of Obstetrics and Gynaecology website and books such as “Medications and mothers milk”⁵ and “Drugs in pregnancy and lactation”.⁶

— Career development

A career as a neonatal pharmacist is rewarding and challenging, with opportunities to work both in an intensive care background and in a “normal” ward setting (ie, SCBU). Although there are differences between paediatrics and neonatology, a paediatric background is invaluable because it gives experience of, for example, dose calculations, licensing issues and using various non-traditional sources for drug information. Working in an adult intensive care environment also provides useful skills.

Unfortunately, there is currently no formal pharmacy postgraduate education in neonatology, although there are various universities that offer modules in paediatrics and intensive care as part of their diploma courses in pharmacy practice. The Neonatal and Paediatric Pharmacy Group hold an annual weekend conference which is attended by neonatal and paediatric phar-

macists from around the country and is structured into lectures and workshops. This event is a great way to learn more about the theory and practice of neonatology (as well as paediatrics) and also to network. Details of this group, together with other useful sources of information, are set out in Panel 1 (p330).

— Further developments

Pharmacist supplementary prescribing is not in place at the neonatal unit at St Mary’s Hospital, although neonatal pharmacists elsewhere in the UK are using this practice development.⁷ I can see the prescribing role expanding over the next few years, particularly as most neonates (unlike, say, many paediatric patients) will need to stay in hospital for a number of weeks.

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