ADMINISTERING MEDICINES INTRAVENOUSLY TO CHILDREN AND YOUNG PEOPLE

A WORKBOOK TO ASSIST PRACTITIONERS IN DEVELOPING COMPETENCE
Acknowledgements

We would like to thank the NHS Modernisation Agency for sponsoring the development of this framework. We are grateful to the following people for their assistance:

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We are also indebted to the following hospitals whose training programmes and other materials were helpful in developing this document:

Central Manchester and Manchester Children’s University Hospital NHS Trust
Bolton Hospitals NHS Trust
Great Ormond Street Hospital for Children NHS Trust
Hull and East Yorkshire Hospitals NHS Trust
Nottingham City Hospital NHS Trust
Oxford Radcliffe Hospitals NHS Trust
University Hospital of Leicester NHS Trust
Royal Free Hospital NHS Trust
Royal Liverpool Children’s Hospital NHS Trust
University College London Hospital NHS Trust
University Hospital of Wales, Cardiff and Vale NHS Trust
Introduction

This workbook should assist practitioners in developing the knowledge that underpins safe practice in administering medicines intravenously to children and young people. It should be used in conjunction with the document *Administering Medicines Intravenously to Children and Young People: A Competency Framework* (RCN, 2005) and form part of a programme of learning.

Aims and objectives

To assist practitioners to develop the underpinning knowledge for safe competent practice in administering intravenous medicines to children and young people.

To assist practitioners in identifying gaps in their knowledge and where further study is needed.

Facilitate educators in assessing knowledge and competence.

How to use this workbook

The workbook has its basis in some of the key learning outcomes described in the document *Administering Medicines Intravenously to Children and Young People: A Competency Framework* (RCN, 2005). In each section there is a brief introduction to the issues followed by self-directed activities for the student to undertake.
PROFESSIONAL AND LEGAL ISSUES


In addition, local policies developed by your hospital should make the boundaries of this practice clear and guide you to performing safely and legally.

**Activity 1**

Read the following documents –
*Code of Professional Conduct* (NMC, 2004),
and your trust’s Medicines Administration Policy.

What do you understand by the terms “competence” and “accountability” in nursing?

What legal, professional and employer issues do you need to consider before administering medicines intravenously to children and young people?

**Gaining consent**

Any informed and competent person can authorise a medical procedure once the implications, side effects and alternatives have been appropriately explained. The age of the patient is not necessarily a major factor for informed consent (BMA\(^1\), 2001). If a child is competent to give consent, you should seek consent directly from them (DH\(^2\), 2001). It should not be assumed that children with learning disabilities are not competent to make decisions; many children will be competent if information is presented in an appropriate way (DH, 2001). In most situations it is desirable to have the parent’s consent in addition to the child’s consent.

Consent can be verbal, written or implied by the child’s actions, such as holding out an arm ready for intravenous medicines to be given. Children may

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\(^1\) British Medical Association

\(^2\) Department of Health
sometimes refuse this treatment because of anxieties over pain during the procedure, the side effects of the medicines or concern that the needle may prick them. Genuine refusal of treatment is based on awareness of the implications (BMA, 2001), rather than short term discomfort. Where the refusal appears consistent, valid and informed, but would be likely to result in serious and avoidable damage to the young person’s health, legal advice should be sought (BMA, 2001). It is also important to think about the ethical implications – which course of action will cause the least harm and the most benefit for the child.

For a child to be able to consent to a treatment, he or she must be allowed to participate in decision making. Encouraging children to make decisions by giving them information and explanations, and respecting their thoughts takes more time than just telling them what’s going to happen, and the time factor is often used as an excuse for not adequately preparing children. However, the procedure itself may take longer and cause more distress if the child is not prepared, and their wishes have not been taken into account (Runeson et al., 2001).

You should explain to the child and carer why the medicine needs to be given. Ensure verbal or implied consent has been given. The Oxford Reference Dictionary (1986) defines consent as “to express willingness or agree (to), to give permission, voluntary agreement”. Consent must be given willingly, without duress, force or fraud (Dimond, 1996).

For children to willingly allow someone to do something uncomfortable or painful to them, they must be able to control their anxiety, and trust the person performing the procedure. Preparing children for procedures and telling them the truth decreases their anxiety (Price, 1995). Conversely, withholding information regarding illness and treatment does not protect the child as they tend to come to conclusions on their own (Perry, 1994). This can be more frightening than reality (Action for Sick Children, 1994). In order to prepare a child for a procedure, they must be given honest factual information about the procedure so that they have an understanding of what will happen to them, and what their role is.

Children younger than eight years of age can understand and make logical decisions about life-changing therapy (Alderson & Montgomery, 1996). In keeping with the philosophy of partnership in decision making with the child, and in encouraging their developing autonomy, the child should be informed of treatment plans, and his or her decisions should be taken seriously (Brykcynska, 1987). ‘Even where younger children do not have the required understanding, they should be provided with as much information as possible and their wishes ascertained and taken into account’ (DH, 1991).

**Activity 2**

Think about a child in your care who is receiving intravenous medicines.

What steps were taken to ensure that the child understood the procedure and was able to give consent?
Restraining children

If a child is wriggling and screaming, you can assume they have not consented to the procedure. Restraining a child means forcefully holding them against their will; holding a child still is done with their cooperation, and some children feel more secure when they are gently held. Being restrained can be more distressing for a child than the pain involved in the procedure (Collier J and Robinson S, 1997).

In order to create a safe environment for administering intravenous medicines it may be necessary to keep the child still. Before restraining a child the nurse should aim to understand and alleviate the cause of any distress.

When the rights of the child are considered it becomes clear that alternatives to restraining should be available and used (Royal College of Nursing, 2003a). Only when the child’s safety and well-being may be compromised by delay should restraining be the preferred option. When appropriate, nurses and parents may gently hold a child's arm in position, or keep a hand still, while intravenous medicines are given. This, in conjunction with other techniques, may be comforting for the child as well as help to ensure the child's safety. If holding the child still is ever undertaken, its ill-effects may be minimized by preparing the parent and child as far as possible in the situation. The child can also subsequently be given further information and offered the chance to discuss events so that they may be able to begin to make sense of what has occurred. Very young children can be held securely, but not too tightly. Wrapping a young child or infant in a light blanket while cuddling and talking to them may be comforting as well as providing effective restraint.

COMMUNICATION

Any nurse working with children and young people must be able to communicate effectively. Communication is a complex process that includes the perceptions and judgements of all individuals involved (Hockenberry MJ et al., 2003). Communication can be verbal, non-verbal and abstract.

- **Verbal communication** includes language, laughter, sighs and moans.

- **Non-verbal communication “body language”** includes gestures, movements, facial expressions, postures and reactions.

- **Abstract communication** involves play, symbols, and pictures.

You may need to use one or more of these when communicating with children, young people and their families.
Listening is a key element of effective communication. “There is also evidence from parents of the need for health professionals to be trained and competent in active listening” (NSF, 2004). To engage in active listening you should take note of all aspects of the conversation, and any gestures or expressions that suggest an underlying messages or anxiety. It is easy for a situation to be influenced by your own perceptions of how you would react or by racial, religious or social stereotypes. The passive or hostile parent may indeed be shy or anxious. The monosyllabic teenager may just be feeling unsafe.

Where a procedure may cause discomfort always be truthful to the child or young person.

Activity 3

Find and read two articles on communicating with children and young people.

Louise is 3 years old. She has a chest infection. This is her first time in hospital. Intravenous antibiotics were prescribed and the first dose given at 1800 hours. This caused some stinging in Louise’s hand. As you go to give the second dose Louise wakes up, recognises the syringe, starts crying and refuses to put her hand forward for you to give the medicines.

What strategies could you use to communicate with Louise in order to gain her co-operation. How would your approach differ if Louise was 13 years old?

MEDICAL DEVICES AND EQUIPMENT

The term “medical device” covers many of those products used daily in most health care settings. It includes any appliance, instrument, apparatus or health care product used in the treatment of disease, for example, needles, syringes, infusion pumps and dressings.

The use of infusion pumps and syringe drivers for giving medicines intravenously is now commonplace and their use can ensure timely, safe treatment. However, in 2002 the Medical Devices Agency reported that for 80% of the adverse incident reports received concerning infusion pumps, user error rather than a faulty device was the cause.

Before using any medical device it is important that you understand how it works, when it is appropriate to use it and how to use it safely and effectively.
Activity 4


Before using any medical device you must reassure yourself that you have undergone appropriate training and are competent to use the device. Increasingly in order to ensure patient safety and comply with standards set by the Clinical Negligence Scheme for Trusts, hospitals now provide training. You and your employer should keep a record of that training.

Activity 5

In the clinical area where you work regularly, find an infusion pump and syringe driver. Read the instruction manuals that accompany these devices and identify the following:

- How the infusion device works
- When the device was last serviced
- How it should be cleaned between patients.

Describe a situation where you would use each device and give a rationale.

Care planning

Patient records are sometimes called as evidence in a court of law or by the Health Care Commissioner. They can also be used to investigate an incident or complaint locally. The Nursing and Midwifery Council uses care plans when investigating allegations of misconduct. One expectation of good record-keeping is that the care plan should give “a full account of your assessment and care you have planned and provided.” (NMC, 2002)
A good care plan allows other nurses caring for the patient to understand the care needed and the underpinning reasons. It should facilitate continuity of care. It should make clear the type of infusion pump being used; the nature and frequency of any observations to be made; possible side effects of the medicines and any dressings used as well as any communication techniques that you have found useful.

**Activity 6**

Devise a care plan for the following situations:

An 8 year old receiving a continuous infusion of morphine via a syringe pump, following an appendicectomy.

A 14 year old receiving antibiotics by intermittent bolus via a peripheral venous cannula in his right hand.

Compare your care plans to examples on your ward.

**MEDICINES MANAGEMENT**

Preparing medicines for children and young people can be a complex process. “Health care professionals who are prescribing, dispensing or administering medicines for children and young people need to be competent, particularly regarding the risks and benefits of medicines, shared decision-making, and in accessing best evidence” (NSF, 2004).

Many medicines prescribed for children are only available in adult dose forms and sometimes complicated calculations are needed when preparing doses for babies and young children. Medicines for Children: Standard 10 (NSF, 2004) and Building a Safer NHS (DH, 2004) emphasise that individuals who administer medicines to children should demonstrate their competence in dose and infusion calculations.

**Calculating doses**

It many instances it may be necessary for you to calculate the amount of a medicine to be given intravenously. You should have an understanding of basic arithmetic even when it is appropriate to use a calculator. Where a second practitioner is used for checking a medicine, he/she should calculate the amount required independently.
Calculations for IV medicine administration

1g = 1000milligrams
1mg = 1000micrograms
1L = 1000mls

It is safest to convert all weights and units to the same unit.

Concentrations

Percentage solutions where the dissolved substance is measured in grams and the solvent is fixed at 100mls = % grams in 100mls.

Example: 10% Dextrose w/v = 10g dextrose in 100mls.

1 in 1000 (1:1000) = 1gram in 1000mls (1milligram in 1ml)
1 in 10000 (1:10000) = 1g in 10000 (0.1 milligram or 100 micrograms in 1ml)

For example: Adrenaline 1 in 10000 (1:10000) = 1g in 10000mls (0.1 milligram in 1ml or 100 micrograms in 1ml)

When everything is in the same units you can calculate the amount needed by using the WIG equation (Haigh, 2002)

\[
\frac{\text{What you want} \times \text{What it is in (volume)}}{\text{What you have got}}
\]

Example: You need Morphine 8 milligrams. The vial contains 10 milligrams in 1ml of solution.

\[
\frac{\text{What you want (8milligrams)}}{\text{What it is in (1ml)}} \times \frac{\text{What it is in (1ml)}}{\text{What you have got (10milligrams)}} = 0.8mls.
\]

Calculating flow rates

These are expressed as volumes of fluid delivered over a specific period of time, usually millilitres (mls) per hour or drops per minute.

\[
\text{Flow rate mls/hr} = \frac{\text{volume of fluid (mls)}}{\text{Time to infuse (hr)}}
\]
Example: 500mls of Sodium Chloride (NaCl) 0.9% over 8 hours

\[
\text{Volume of fluid (500mls)} = 62.5 \text{ mls/hr} \\
\text{Time to infuse (8hrs)}
\]

**Drops per minute**

To calculate drops per minute you will need to know:

- Volume of fluid to be infused
- Total infusion time
- Calibration of administration set used (number of drops per ml. This is stated on the package)

Example: 15 drops/ml for blood sets
  - 20 drops/ml for solution sets
  - 60 drops/ml for burettes

Flow rate: \[
\frac{\text{mls to be infused} \times \text{number of drops per ml (giving set)}}{\text{Hours to be delivered} \times \text{Time in minutes (60)}}
\]

Example: 1Litre of fluid over 12 hours using a burette

Flow rate: \[
\frac{1000 \text{mls} \times 60}{12 \text{hrs} \times 60 \text{ (min)}} = 83 \text{ drops per minute}
\]

**Activity 7**

Using the above formulae calculate the following:

**Cefotaxime:**

The dose is 50 milligrams per Kilogram (Kg) given either twice or four times daily.
What is the correct dose for a child weighing 8Kg?

A vial contains 500 milligrams. Reconstitution requires 1.8 millilitres of water for injection to be added to give a concentration of 250 milligrams per ml.

How much of the solution do you need to draw up?
Vancomycin

A child is prescribed 350 milligrams of vancomycin. The vial contains 1 gram. Reconstitution required 19.4 mls water for injection to give a concentration of 50 milligrams per ml.

How much solution do you need to draw up?

Potassium chloride

KCL (Potassium Chloride) 15 millimoles is prescribed as an additive to a 500ml bag of 0.45% NaCl / 5% dextrose solution.

The vial contains 20 millimoles in 10 mls. How much will you add to the bag?

Insulin

A child is prescribed 50 units of insulin diluted in 50 mls of 0.9% NaCl

The vial contains 100 units per ml.

What volume of insulin will you draw up?
What syringe will you use?

Administration

Medicines can be given intravenously by several methods; continuous, intermittent or bolus. A fluid bag or syringe is used for continuous infusions and a burette or syringe for intermittent infusions. A bolus can be given into a running infusion, an injection access site (e.g. injection cap or needle free system) injection or as a positive pressure flush (Heparin and sodium chloride flush solutions only). It is important that the correct method is used.
**Activity 9**


List the areas of good practice that are important when giving intravenous medicines to children and young people.

Describe the checks you should make when preparing and giving intravenous medicines.

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**RISKS AND HAZARDS**

Intravenous medicines may produce unexpected adverse reactions. The use of this route, although effective in many instances, can also be hazardous. You must ensure that any adverse effects are recorded and reported.

**COMPLICATIONS**

**Anaphylaxis**

Hypersensitivity can result in varying degrees of anaphylaxis. The signs can range from a mild rash to laryngeal oedema, bronchospasm, hypotension and death. It is more common after intravenous administration.

This is a medical emergency. Treatment includes airway and blood pressure management and the administration of epinephrine.

You should check that any allergies or reactions to medicines, food or other substances for example, balloons indicating a latex allergy, are documented.

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**Activity 10**

Read your hospital’s anaphylaxis protocol or the relevant chapter in the BNF for Children (2005)

What are the signs of anaphylaxis?

What action would you take if a child presented with any of these symptoms while you were giving intravenous medicines?
 Extravasation of medicines into the tissues

Extravasation is the inadvertent administration of vesicant medication or solution into the surrounding tissue instead of the intended vascular pathway. A vesicant is an agent capable of causing injury when it escapes from the intended vascular pathway into surrounding tissue (RCN, 2003, INS, 2000). When a vesicant enters the surrounding tissue blistering, tissue damage and necrosis may occur. The injury if untreated could result in significant disfiguration. At its worst extravasation can damage nerves and tendons resulting in limited movement.

Infusion sites should be observed regularly. Macdonald (2001) states that visually checking and palpating a site at least hourly and make accurate recordings. Dressings should allow for easy observation and bandages should be removed in order that checks can be made. Where extravasation is suspected the medicine should not be given and your local policy followed.

Activity 11

Read the following documents and then answer the question.

Standards for Infusion Therapy (RCN, 2005)
Your hospital’s policy on extravasation injuries or wound management.

- What are the signs and symptoms of extravasation?
- What action would you take if you suspected extravasation?
- What factors can reduce the risk of extravasation?

Fluid overload

Some intravenous medicines must be diluted in large volumes of fluid. In other instances a child’s renal function may be impaired or fluids may be restricted. In all of these situations fluid overload can result. Intravenous medicines should be included in fluid balance calculations.

Infection/contamination

Patients with an intravenous access device in place have an increased risk of local and systemic infection. The Department of Health issued guidance to reduce the risk of infection in peripheral venous cannulae, parenteral nutrition lines and central venous access devises in the document, Winning Ways: Working together to reduce healthcare associated infections in England (DH, 2003).
This includes keeping lines, lumens and stopcocks to a minimum; inspecting sites regularly for signs of infection; removing the cannula if infection is suspected.

All equipment used for giving intravenous medicines must be sterile, free from contamination and suitable. Rigorous hand washing, aseptic techniques and minimal manipulation can help to reduce the risk of infection.

**Infiltration**

This can be defined as the inadvertent administration of non-vesicant medication or solution into the surrounding tissues instead of the intended vascular pathway. (NS, 2000)

**Medicine toxicity**

Some medicines can be harmful if the plasma level exceeds the therapeutic level. This can be the result of high dosage, failure to excrete or toxic metabolites. Where blood tests are needed to monitor the drug levels, your role is to check that this has happened before you administer a further dose.

**Pain**

Some pain or discomfort may occur as the result of the pH of the medicine being given. You should consider steps to minimise any pain, such as dilution and giving it slowly. Always tell the child or young person if it is likely to hurt.

**Phlebitis**

Children may be at greater risk of phlebitis due to their small veins and reduced blood flow around the device. Chemical phlebitis can result from irritant medicines. Further dilution or use of a central vein may be necessary.

Mechanical phlebitis can occur when the intravascular device causes friction against the vessel wall. It can be prevented by using a cannula of an appropriate size and securing the cannula effectively.

**Speed shock**

This can occur when the medicine is given too quickly. Hypotension, tachycardia and facial flushing may occur and the child may become distressed.
RISK MANAGEMENT

Risk is the chance of an untoward event happening that may either cause harm or have an impact on the organisation’s patients, staff, contractors, visitors (including the general public), assets and/or reputation. Clinical risk management is an approach to improving the safe delivery of healthcare by:

- Placing special emphasis on identifying circumstances that put patients at risk of harm
- Acting to prevent or control those risks

All medical, nursing and allied health professionals have a responsibility for assessing risks related to the clinical care they provide. They must ensure children, young people and their families are given sufficient information to make informed choices regarding their treatment and any potential risks or side-effects. They must ensure records meet the standards of the relevant professional body.

You should report all adverse/serious or near miss incidents in accordance with your hospital policy. You must ensure immediate action is taken or instigated, if required, to ensure patient/visitor/staff safety.

Activity 12

Read your hospital’s Adverse Incident Procedure. Consider these questions.

You are about to give an intravenous medicine. The prescription is unclear and not written in capitals. What action would you take?

When checking the dosage you realise a prescription error may have occurred. What action would you take?

The sister with whom you are about to check an intravenous medicine is not following the correct checking procedures. What action would you take?

FURTHER LEARNING

Your expertise in administering medicines intravenously to children and young people will develop gradually and you will become more confident in your practice. From your learning so far, including any supervised practice you have undertaken, you should have a good understanding of the knowledge and skills you will need to practice safely in this area.
**ACTIVITY 13**

Reflect on your learning and knowledge so far and undertake the following:

Identify the areas where you feel your knowledge is at a level where you can practice safely.

Identify areas where you need more information and support in developing your knowledge and skill.

Consider what actions you will take to continually develop your skill in administering medicines intravenously to children and young people.

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The RCN fully supports members in raising concerns regarding the care of children and young people, and the protection of their rights as individuals.

If you feel compromised - for example if training provided by your employing organisation is inadequate and you are not getting the help you need - contact RCN Direct on 0845 772 6100 or ring your local RCN Office (contact numbers can be found in your RCN Diary and Members’ Handbook).
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