Intravenous Medicine Administration

Self directed Learning Pack

If you require further information contact:

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Introduction

This self-directed learning package is designed to help you identify and highlight some of the issues associated with Intravenous (IV) medicine / fluid administration in the clinical setting prior to the study day. This is part of a package, which requires you to complete the Intravenous Administration Training Tracker module. Once completed, print off the certificate and bring with you on the IV study day as evidence.

Your Training Tracker module certificate forms part of the evidence you require to support your claim of competence in IV medicine / fluid administration whether this be to refresh or as a new skill.

The learning package is designed to:

- Reflect on existing experience
- Access and read the core documents that will guide your practice
- Investigate some of the issues associated with IV medicine / fluid administration
- Identify gaps in your own knowledge and areas for development
- Focus on risk management issues

There are also a Reflection session included for you to reflect on your learning and how you will apply this in practice.

Intravenous Medicine Administration

Self Directed Learning Pack

Aims

To enable the trained nurse to promote safe standards of nursing care through increased knowledge of the professional and legal requirements of Intravenous administration.

To heighten awareness of the knowledge and skills required for the safe practice of intravenous therapy and drug administration.

To be aware of the most up to date evidence around drug administration and the risks involved.

Outcomes

1. Indicate educational needs in relation to intravenous therapy and drug administration.

2. Identify legal and professional implications of the registered practitioner's role.

Specifically, in relation to intravenous therapy, intravenous drug administration and practice.

3. Identify local and national policies/procedures/documents with regard to the maintenance of intravenous therapy and administration of intravenous drugs and fluids.

4. Recognise and demonstrate safe standards of nursing practice.

5. Use relevant research to support nursing practice.

6. Describe and identify infection hazards.

7. State potential problems with IV administration drug/fluid therapy.

8. Identify appropriate action to take in response to an adverse reaction.

9. Be familiar with equipment in use in clinical areas.

10. Be aware of the medical devices that you will use to assist in the safe administration of intravenous medicine.

11. Identify potential hazards/complications of intravenous equipment and infusion devices.

12. Identify resource personnel for intravenous therapy, drug/fluid administration, intravenous equipment and infusion devices.

Legal and professional issues

This workbook aims to assist the learner to understand the requirements in the following areas relating to medicines administration:

- Accountability
- Legal Responsibility
- Negligence
- Vicarious Liability
- Reasonable Care
- Valid Consent
- Local policies and procedures
- Implications for the practitioner

- All healthcare practitioners must be aware of the professional issues related to performing a new skill such as medicines administration. This ensures a safe and effective procedure for all parties concerned.
- As professionals, healthcare practitioners are accountable for their actions and must adhere to the stated principles of their professional bodies.

Accountability

- There are four areas of accountability:
  1. Criminal Law (for example manslaughter by gross negligence)
  2. Civil Liability (e.g. action for negligence)
  3. Professional Liability
  4. Accountability to Employer

Nursing and Midwifery practitioners should refer to the Nursing and Midwifery Council (NMC)'s:

The code: Standards of conduct, performance and ethics for Nurses and midwives (2008).

Other health care professionals have an equal code of conduct which will provide clear and robust guidelines.

Duty of care

- Healthcare practitioners owe a legal duty of care to their patients.
- The duty of care is a legal status which is held by registered practitioners when they are involved in planning, delivering and evaluating care.
- The duty of care is passed from one shift to another, one department to another so that someone is accountable for the patient or client at all times.
- The duty of care is only relinquished if the patient is handed over, transferred out, discharged home (as a care episode has ended) or if they die.
- The Standard of Care which applies is that of a responsible body of practitioners in the relevant speciality. Two practitioners who are level in rank should display and possess similar levels of skills and knowledge. If they do not, it must be addressed.
- Responsible means just that, it is not equal to accountability. It does not necessarily mean the 'majority' and it will be measured by the knowledge at the time the event took place. Non-registered practitioners can assume responsibility as they are aware of their actions and limitations.
- If a practitioner breaches their duty of care, and in doing so causes actual harm to a patient, the patient may be entitled to compensation.

- Negligence requires three conditions to be satisfied:
    1. The practitioner owed the patient a duty of care
    2. A breach of that duty has occurred
    3. As a result of this breach, harm has been caused to the claimant.

Vicarious Liability

- An employer will bear vicarious responsibility for the acts and omissions of its employees unless they are on a 'frolic of their own'. i.e. acting outside the normal course of their duties. It would be extremely unusual for an employer of a healthcare practitioner to avoid vicarious responsibility for the acts of the practitioner done in the course of his or her duties.
- All NHS clinical and nursing practitioners are subject to NHS indemnity. Under this the NHS takes responsibility for legal proceedings brought against an employee arising from their NHS activities.
- An employer can also be held to be directly liable where the standard of care owed by the Trust to the patient has been breached. For example by failing to supply sufficient or properly qualified staff.

- It is recommended that all staff also have personal insurance via a professional body e.g. RCN, RCM, BMA, HPC

Reasonable Care

The Standard of Care

- Healthcare practitioners must attain the standard of a responsible body of practitioners professing the particular speciality under scrutiny (This is known as the Bolam Test). What amounts to a "responsible body" must withstand logical analysis.
- Two practitioners who are level in rank should display and possess similar levels of skills and knowledge. If they do not it must be addressed.
- This can be measured using the Bolam Principle which is a legal template for measuring ability of medical/clinical practitioners. This was based on a case from 1957 where Mr Bolam, a psychiatric patient was injured due to one doctor's inexperience (look it up on the internet)

The same standard of care applies to an emergency situation.

Example:
A nurse witnessing a road traffic accident will be required to stop and offer help to the standard of a responsible practitioner trained in this procedure, whether or not she is experienced in doing so.

Inexperience

In law the same standard of care is expected of an inexperienced practitioner as of an experienced practitioner. A student nurse, for example, will be required to attain the same standard as an experienced nurse if she undertakes the procedure.

Orders

Where a healthcare practitioner receives an order regarding treatment and carries it out without due consideration they may be breaching the duty of care. It is rarely a defence to claim to be merely following orders. The practitioner must show that the action was reasonable having regard to approved practice to be expected from a practitioner trained in the procedure.

Local Policies and Guidance

As far as reasonable, local policies and procedures should be followed. However, in some circumstances there may be reasons why a particular policy is inappropriate and it may be justifiable not to follow procedure. Where a practitioner does not follow usual practice but the actions were in accordance with the standard of reasonable care there is no breach of duty.

It is recommended that where a policy is not followed, the practitioner records what was done and why the circumstances justified a modification from usual practice.

The Health Act

The Health Act 2006 requires NHS bodies to protect patients and staff from healthcare associated infection. This requires the implementation of policies related to standard infection control precautions and aseptic techniques as set out in the "Code of Practice for the Prevention and Control of Healthcare Associated Infections". This code draws on a number of recommended guidelines.

Consent

Adult mentally competent patients have an absolute right to decide whether to accept or refuse treatment.

Information to be provided before consent

- Before consent is provided a patient should receive some explanation of the treatment to be undertaken. The explanation should be in line with that which would be provided by a responsible body of practitioners. Where a patient asks questions they should be answered fully. How much detail should be given depends on the particular circumstances.

- For medicines administration it is recommended that, before consent can be given, an individual should be aware of the reason for having a cannula inserted, the procedure of doing this, what is involved and long it will take.

Form of Consent

- Consent can be given verbally, can be in writing or can be implied through conduct.

- In medicines administration, a patient offering their arm for insertion can imply consent provided that the elements of consent are satisfied.

- Verbal consent should be recorded in the patient's notes and should be limited to those procedures where there is little risk.

Who may provide consent?

- Consent cannot be given by proxy. Where an adult patient is mentally incapable of giving his consent, no one (including the court) can give consent on his/her behalf. Treatment in such a case

may lawfully be provided by a healthcare practitioner where the treatment is in the best interests of the patient.

- Those with parental responsibility for a child will usually have the legal power to give or withhold consent for a child's treatment unless they conflict with the interpretation of those providing care about the child's best interests

- Consent by children under 16 years of age depends upon the child's ability to understand the nature and the implications of the treatment. The ability to understand has to be determined by the medical practitioner or the relevant health professional.

- As a result of the Mental Capacity Act 2005, which comes into force on 2 April 2007, practitioners will be obliged to assess the capacity of all patients whom they believe do not have capacity to consent to or refuse treatment. Having established a patient lacks capacity the practitioner will be obliged to act in that patient's best interest.

Who should request consent?

- Consent must be taken by a practitioner who is both capable of performing the procedure and is able to explain the risks and benefits.

Elements of Consent

- For valid consent following elements must be satisfied:

  - **Capacity**: Ensure that the patient/client is capable of giving consent. Adults are always assumed to be competent unless demonstrated otherwise.
  - **Voluntary**: An individual must be free to choose. Consent must be given without coercion.
  - **Informed**: Patients are entitled to receive sufficient information in a way they can understand about the proposed treatment, the possible alternatives, and any substantial risks so they can make a balanced judgment
  - **Specific**: The consent given must be specific to the situation
  - **Current**: Giving and obtaining consent is usually a process, not a one off event. Patients can change their minds and withdraw consent at any time. If there is any doubt, you should double check with the patient what their current wishes are.

<u>Local Policies and Procedures</u>

- Local policy and procedures may be found to support medicines administration in every area.

- The policies may have variances but should be followed. They will include information on training, cannula selection, skin preparation and aftercare pertaining to the local environment.

- It is the responsibility of the practitioner to follow local policy and procedure guidelines, or discuss any deviations with the author of such guidelines.

- Standards for competence will also be issued by each Trust. These must be followed to ensure completion and confirmation of competence.

Implications for the practitioner

In practice these issues mean that a practitioner should:

- Check that he/she has the training and supervision identified by local policy before carrying out the procedure.
- Feel competent to carry out the procedure. Justifying competence can be achieved by keeping a log of supervised practice and training. Ensuring reflective practice and critical analysis.
- Carry out the procedure in accordance with the local policy.
- Keep up to date with changes in practice and use his/her skill regularly.
- never attempt medicines administration unless he/she is confident with all aspects required to be considered, before, during and after medicines administration procedure.
- Always refer to an experienced colleague before medicines administration procedure if he/she is unsure.
- Ensure that the procedure is fully documented in the records
- Follow the NMC guidance and recommendations.
    - Registered Nurses must comply with the NMC's Code of Professional Conduct (2008). This Code has been designed to provide a clear framework for logical development of practice. The code emphasises the need for application of knowledge and the exercise of professional judgement and skill (see section 6). Responsibility and accountability are placed on the individual. The Code also advises nurses to acknowledge personal skill and take steps to remedy any deficits.
    - NMC (2005) recommends that:
        - Documentation should provide clear evidence of the care planned, the care delivered and the information shared
        - Good record keeping is a mark of a skilled and safe practitioner
        - Good record keeping helps to protect the welfare of patients and clients

The Code (2008)

Theme 1: Make the care of people your first concern, treating them as individuals and respecting their dignity

Treat people as individuals

- 1. You must treat people as individuals and respect their dignity
- 2. You must not discriminate in any way against those in your care
- 3. You must treat people kindly and considerately
- 4. You must act as an advocate for those in your care, helping them to access relevant health and social care, information and support

Respect people's confidentiality

- 5. You must respect people's right to confidentiality
- 6. You must ensure people are informed about how and why information is shared by those who will be providing their care
- 7. You must disclose information if you believe someone may be at risk of harm, in line with the law of the country in which you are practising

Collaborate with those in your care

- 8. You must listen to the people in your care and respond to their concerns and preferences
- 9. You must support people in caring for themselves to improve and maintain their health
- 10. You must recognise and respect the contribution that people make to their own care and wellbeing
- 11. You must make arrangements to meet people's language and communication needs
- 12. You must share with people, in a way they can understand, the information they want or need to know about their health

Ensure you gain consent

- 13. You must ensure that you gain consent before you begin any treatment or care
- 14. You must respect and support people's rights to accept or decline treatment and care
- 15. You must uphold people's rights to be fully involved in decisions about their care
- 16. You must be aware of the legislation regarding mental capacity, ensuring that people who lack capacity remain at the centre of decision making and are fully safeguarded
- 17. You must be able to demonstrate that you have acted in someone's best interests if you have provided care in an emergency

Maintain clear professional boundaries

- 18. You must refuse any gifts, favours or hospitality that might be interpreted as an attempt to gain preferential treatment
- 19. You must not ask for or accept loans from anyone in your care or anyone close to them
- 20. You must establish and actively maintain clear sexual boundaries at all times with people in your care, their families and carers

Theme 2: Work with others to protect and promote the health and wellbeing of those in your care, their families and carers, and the wider community

Share information with your colleagues

- 21. You must keep your colleagues informed when you are sharing the care of others
- 22. You must work with colleagues to monitor the quality of your work and maintain the safety of those in your care
- 23. You must facilitate students and others to develop their competence

Work effectively as part of a team

- 24. You must work cooperatively within teams and respect the skills, expertise and contributions of your colleagues
- 25. You must be willing to share your skills and experience for the benefit of your colleagues
- 26. You must consult and take advice from colleagues when appropriate
- 27. You must treat your colleagues fairly and without discrimination
- 28. You must make a referral to another practitioner when it is in the best interests of someone in your care

Delegate effectively

- 29. You must establish that anyone you delegate to is able to carry out your instructions
- 30. You must confirm that the outcome of any delegated task meets required standards
- 31. You must make sure that everyone you are responsible for is supervised and supported

Manage risk

- 32. You must act without delay if you believe that you, a colleague or anyone else may be putting someone at risk
- 33. You must inform someone in authority if you experience problems that prevent you working within this code or other nationally agreed standards
- 34. You must report your concerns in writing if problems in the environment of care are putting people at risk

Theme 3: Provide a high standard of practice and care at all times

Use the best available evidence

- 35. You must deliver care based on the best available evidence or best practice

- 36. You must ensure any advice you give is evidence based if you are suggesting healthcare products or services
- 37. You must ensure that the use of complementary or alternative therapies is safe and in the best interests of those in your care
  Complementary alternative therapies and homeopathy

Keep your skills and knowledge up to date

- 38. You must have the knowledge and skills for safe and effective practice when working without direct supervision
- 39. You must recognise and work within the limits of your competence
- 40. You must keep your knowledge and skills up to date throughout your working life
- 41. You must take part in appropriate learning and practice activities that maintain and develop your competence and performance

Keep clear and accurate records

Record keeping: Guidance for nurses and midwives

- 42. You must keep clear and accurate records of the discussions you have, the assessments you make, the treatment and medicines you give and how effective these have been
- 43. You must complete records as soon as possible after an event has occurred
- 44. You must not tamper with original records in any way
- 45. You must ensure any entries you make in someone's paper records are clearly and legibly signed, dated and timed
- 46. You must ensure any entries you make in someone's electronic records are clearly attributable to you
- 47. You must ensure all records are kept securely

Theme 4: Be open and honest, act with integrity and uphold the reputation of your profession

Act with integrity

- 48. You must demonstrate a personal and professional commitment to equality and diversity
- 49. You must adhere to the laws of the country in which you are practising
- 50. You must inform the NMC if you have been cautioned, charged or found guilty of a criminal offence
- 51. You must inform any employers you work for if your fitness to practise is called into question

Deal with problems

- 52. You must give a constructive and honest response to anyone who complains about the care they have received
- 53. You must not allow someone's complaint to prejudice the care you provide for them
- 54. You must act immediately to put matters right if someone in your care has suffered harm for any reason

- 55. You must explain fully and promptly to the person affected what has happened and the likely effects
- 56. You must cooperate with internal and external investigations

Be impartial

- 57. You must not abuse your privileged position for your own ends
- 58. You must ensure that your professional judgment is not influenced by any commercial considerations

Uphold the reputation of your profession

- 59. You must not use your professional status to promote causes that are not related to health
- 60. You must cooperate with the media only when you can confidently protect the confidential information and dignity of those in your care
- 61. You must uphold the reputation of your profession at all times

Standards for Medicines Management (2010)

Section 1: Methods of supplying and/or administration of medicines

Standard 1: Methods

Registrants must only supply and administer medicinal products in accordance with one or more of the following processes:

- Patient specific direction (PSD)
- Patient medicines administration chart (may be called medicines administration record MAR)
- Patient group direction (PGD)
- Medicines Act exemption
- Standing order
- Homely remedy protocol
- Prescription forms

Standard 2: Checking

Registrants must check any direction to administer a medicinal product.

Standard 3: Transcribing

As a registrant you may transcribe medication from one 'direction to supply or administer' to another form of 'direction to supply or administer'.

Section 2: Dispensing

Standard 4: Prescription medicines

Registrants may in exceptional circumstances label from stock and supply a clinically appropriate medicine to a patient, against a written prescription (not PGD), for self-administration or administration by another professional, and to advise on its safe and effective use.

Standard 5: Patients' own medicines

Registrants may use patients' own medicines in accordance with the guidance in this booklet *Standards for medicines management*.

Section 3: Storage and transportation

Standard 6: Storage

Registrants must ensure all medicinal products are stored in accordance with the patient information leaflet, summary of product characteristics document found in dispensed UK-licensed medication, and in accordance with any instruction on the label.

Standard 7: Transportation

Registrants may transport medication to patients including controlled drugs, where patients, their carers or representatives are unable to collect them, provided the registrant is conveying the medication to a patient for whom the medicinal product has been prescribed, (for example, from a pharmacy to the patient's home).

Section 4: Standards for practice of administration of medicines

Standard 8: Administration

As a registrant, in exercising your professional accountability in the best interests of your patients:

- you must be certain of the identity of the patient to whom the medicine is to be administered
- you must check that the patient is not allergic to the medicine before administering it
- you must know the therapeutic uses of the medicine to be administered, its normal dosage, side effects, precautions and contra-indications
- you must be aware of the patient's plan of care (care plan or pathway)
- you must check that the prescription or the label on medicine dispensed is clearly written and unambiguous
- you must check the expiry date (where it exists) of the medicine to be administered
- you must have considered the dosage, weight where appropriate, method of administration, route and timing,
- you must administer or withhold in the context of the patient's condition, (for example, Digoxin not usually to be given if pulse below 60) and co-existing therapies, for example, physiotherapy
- you must contact the prescriber or another authorised prescriber without delay where contra-indications to the prescribed medicine are discovered, where the patient develops a reaction

to the medicine, or where assessment of the patient indicates that the medicine is no longer suitable .

- You must make a clear, accurate and immediate record of all medicine administered, intentionally withheld or refused by the patient, ensuring the signature is clear and legible. It is also your responsibility to ensure that a record is made when delegating the task of administering medicine.

In addition:

- Where medication is not given, the reason for not doing so must be recorded.
- You may administer with a single signature any prescription only medicine (POM), general sales list (GSL) or pharmacy (P) medication.

In respect of controlled drugs:

- These should be administered in line with relevant legislation and local standard operating procedures.
- It is recommended that for the administration of controlled drugs a secondary signatory is required within secondary care and similar healthcare settings.
- In a patient's home, where a registrant is administering a controlled drug that has already been prescribed and dispensed to that patient, obtaining a secondary signatory should be based on local risk assessment.
- Although normally the second signatory should be another registered health care professional (for example doctor, pharmacist, dentist) or student nurse or midwife, in the interest of patient care, where this is not possible, a second suitable person who has been assessed as competent may sign. It is good practice that the second signatory witnesses the whole administration process. For guidance, go to www.dh.gov.uk and search for safer management of controlled drugs: guidance on standard operating procedures.
- In cases of direct patient administration of oral medication from stock in a substance misuse clinic, it must be a registered nurse who administers, signed by a second signatory (assessed as competent), who is then supervised by the registrant as the patient receives and consumes the medication.
- You must clearly countersign the signature of the student when supervising a student in the administration of medicines.

Standard 9: Assessment

As a registrant, you are responsible for the initial and continued assessment of patients who are self-administering and have continuing responsibility for recognising and acting upon changes in a patient's condition with regards to safety of the patient and others.

Standard 10: Self-administration – children and young people

In the case of children, when arrangements have been made for parents or carers or patients to administer their own medicinal products prior to discharge or rehabilitation, the registrant should ascertain that the medicinal product has been taken as prescribed.

Standard 11: Remote prescription or direction to administer

In exceptional circumstances, where medication has been previously prescribed and the prescriber is unable to issue a new prescription, but where changes to the dose are considered necessary, the use of information technology (such as fax, text message or email) may be used but must confirm any change
to the original prescription.

Standard 12: Text messaging

As a registrant, you must ensure that there are protocols in place to ensure patient confidentiality and documentation of any text received including: complete text message, telephone number (it was sent from), the time sent, any response given, and the signature and date when received by the registrant

Standard 13: Titration

Where medication has been prescribed within a range of dosages, it is acceptable for registrants to titrate dosages according to patient response and symptom control and to administer within the prescribed range.

Standard 14: Preparing medication in advance

Registrants must not prepare substances for injection in advance of their immediate use or administer medication drawn into a syringe or container by another practitioner when not in their presence.

Standard 15: Medication acquired over the internet

Registrants should never administer any medication that has not been prescribed, or that has been acquired over the internet without a valid prescription.

Standard 16: Aids to support compliance

Registrants must assess the patient's suitability and understanding of how to use an appropriate compliance aid safely.

Section 5: Delegation

Standard 17: Delegation

A registrant is responsible for the delegation of any aspects of the administration of medicinal products and they are accountable to ensure that the patient, carer or care assistant is competent to carry out the task.

Standard 18: Nursing and midwifery students

Students must never administer or supply medicinal products without direct supervision

Standard 19: Unregistered practitioners

In delegating the administration of medicinal products to unregistered practitioners, it is the registrant who must apply the principles of administration of medicinal products as listed above. They may then delegate an unregistered practitioner to assist the patient in the ingestion or application of the medicinal product.

Standard 20: Intravenous medication

Wherever possible, two registrants should check medication to be administered intravenously, one of whom should also be the registrant who then administers the intravenous (IV) medication.

Section 6: Disposal of medicinal products

Standard 21: Disposal

A registrant must dispose of medicinal products in accordance with legislation.

Section 7: Unlicensed medicines

Standard 22: Unlicensed medicines

A registrant may administer an unlicensed medicinal product with the patient's informed consent against a patient-specific direction but NOT against a patient group direction.

Section 8: Complementary and alternative therapies

Standard 23: Complementary and alternative therapies

Registrants must have successfully undertaken training and be competent to practise the administration of complementary and alternative therapies.

Section 9: Management of adverse events (errors or incidents) in the administration of medicines

Standard 24: Management of adverse effects

As a registrant, if you make an error you must take any action to prevent any potential harm to the patient and report as soon as possible to the prescriber, your line manager or employer (according to local policy) and document your actions. Midwives should also inform their named supervisor of midwives.

Standard 25: Reporting adverse reactions

As a registrant, if a patient experiences an adverse drug reaction to a medication, you must take any action to remedy harm caused by the reaction. You must record this in the patient's notes, notify the prescriber (if you did not prescribe the drug) and notify via the Yellow Card Scheme immediately.

Section 10: Controlled drugs

Standard 26: Controlled drugs

Registrants should ensure that patients prescribed controlled drugs are administered these in a timely fashion in line with the standards for administering medication to patients. Registrants should comply with and follow the legal requirements and
approved local standard operating procedures for controlled drugs that are appropriate for their area of work.

Accountability

The NMC Accountability guidelines (2009) state:

Responsibility

Nurses and midwives hold a position of responsibility and other people rely on them. They are professionally accountable to the NMC, as well as having a contractual accountability to their employer and are accountable to the law for their actions. The code says that:

"As a professional, you are personally accountable for actions and omissions in your practice and must always be able to justify your decisions".

and,

"You must always act lawfully, whether those laws relate to your professional practice or personal life."

If a nurse or midwife is asked to deliver care they consider unsafe or harmful to a person in their care, they should carefully consider their actions and raise their concerns to the appropriate person. Nurses and midwives must act in the best interest of the person in their care at all times.

Delegation

If the nurse or midwife is delegating care to another professional, health care support staff, carer or relative, they must delegate effectively and are accountable for the appropriateness of the delegation. The code requires that nurses and midwives must

- establish that anyone they delegate to is able to carry out their instructions
- confirm that the outcome of any delegated task meets required standards
- make sure that everyone they are responsible for is supervised and supported

Your judgement

Accountability is integral to professional practice. Nurses and midwives make judgements in a wide variety of circumstances. Nurses and midwives use their professional knowledge, judgement and skills to make a decision based on evidence for best practise and the person's best interests. Nurses and midwives need to be able to justify the decisions they make.

Clinical Risk and Patient Safety

The process, by which an organisation makes patient care safer, is known as Clinical Risk Management or Patient Safety, terms that are often used interchangeably. The process should involve: risk assessment, the identification and management of patient-related risks; the reporting and analysis of incidents; and the capacity to learn from and follow-up on incidents and implement solutions to minimise the risk of them occurring.

Every day over one million people are treated successfully by National Health Service (NHS) acute, ambulance and mental health trusts. However, healthcare relies on a range of complex interactions of people, skills, technologies and drugs, and sometimes things do go wrong. For most countries, patient safety is now the key issue in healthcare quality and risk management. The Department of Health estimates that one in ten patients admitted to NHS hospitals will be unintentionally harmed, a rate similar to other developed countries. Around 50 per cent of these patient safety incidents could have been avoided, if only lessons from previous incidents had been learned.

There have been various estimates of the number of patient safety incidents:

The Department of Health (An organisation with a memory, 2000) stated that 850,000 hospital admissions led to adverse events based on 8.5 million inpatient episodes a year. It also suggested that 10% of hospital inpatient episodes led to harmful adverse events, of which around half could have been prevented.

The National Audit Office report on patient safety (November 2005) NAO survey, found that there were around 974,000 reported incidents and near misses to trusts' own risk management systems in 2004/05 (excluding hospital-acquired infections). It also found around 2,180 incidents resulting in death (included in the total 974,000 reported incidents).

Reporting and investigating patient safety incidents

A patient safety incident is any unintended or unexpected incident which could have or did lead to harm for one or more patients receiving NHS care (NPSA), for example, medication errors, wrong site surgery, delayed diagnosis, delay in treatments of procedures and

Approximately 500 incidents are reported by staff in the Trust each month, 70% of these incidents are patient safety incidents.

All incidents relating in harm must be reported, whatever the level of severity, this is a Care Quality Commission requirement. The reporting of those incidents which did not lead to harm is also very important. Reporting means that we can investigate incidents and learn about what actions will prevent incidents from reoccurring.

In the Trust the majority of incidents result in a near miss, no harm or low harm to the patient. These incidents will normally be investigated by the department manager, in the first instance the department manager should be contacted if you do not receive feedback for you incident report.

In certain circumstances, for example where a patient suffers severe harm as a result of a patient safety incident, a serious incident investigation will be undertaken by an appointed investigation team who have been trained in Root Cause Analysis (RCA), a method of investigation that looks at systems and process rather than individual blame. The incident investigation team will make recommendations and an action plan to improve our systems, reducing the risk of a similar incident happening again. The Patient Safety and Quality Committee monitor the completion of actions to ensure that improvements are made. We will be sharing some of those improvements with you in future issues.
80% of incidents are reported using the electronic incident form accessible via the incident form icon on the Trust intranet home page.

What can you do to maintain and improve patient safety in our Trust?

- Follow Trust policies, procedures and competency guidelines
- Keep your knowledge and skills up to date and continue to develop yourself professionally.
- Adhere to Mandatory training requirements
- Complete IR1 forms when an incident happens or a near miss occurs
- If you don't receive feedback, ask your manager what has been done as a result of your incident form
- Respect your colleagues, team support is vital. We can all make mistakes, it is important that our staff feel able to report errors and raise concerns within their multidisciplinary team.
- Good communication is essential, miscommunication contributes to the occurrence of patient safety incidents
- Get involved in projects to improve patient care, for example audits being carried out in your area and the productive ward project

NHS
National Patient Safety Agency

The National Patient Safety Agency leads and contributes to improved, safe patient care by informing, supporting and influencing the health sector. It was set up in

They lead and contribute to improved, safe patient care by **informing**, **supporting** and **influencing** organisations and people working in the health sector.

They are an Arm's Length Body of the Department of Health and through their three divisions, cover the UK health service.

National Reporting and Learning Service
Aims to reduce risks to patients receiving NHS care and improve safety.

National Clinical Assessment Service
Supports the resolution of concerns about the performance of individual clinical practitioners, to help ensure their practice is safe and valued.

National Research Ethics Service
Protects the rights, safety, dignity and well-being of research participants that are part of clinical trials and other research within the NHS.

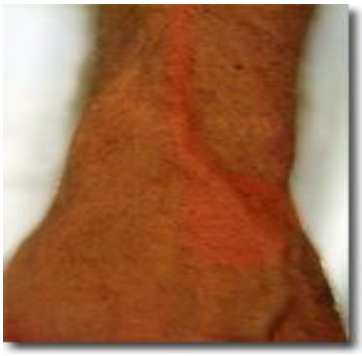
NPSA will issue alerts of drugs which are high risk or to be withdrawn.
This process via the National Reporting and Learning Service.
See: www.npsa.nhs.uk

Potential Complications of Intravenous Therapy

The potential complications identified may have serious consequences for both the practitioner and the individual having a cannula inserted, leading to serious negative outcomes and extended time in hospital. Prevention of complications before, during and following cannula insertion is essential.

Phlebitis

Phlebitis is defined as the inflammation of a vein. ("phleb" = vein, "itis" = inflammation of)



It is progressive and there are three main types:

- chemical
- mechanical
- bacterial

Symptoms include pain, redness, warmth, oedema, induration, palpable cord and purulence. (Lamb 1996)

There are three areas of risk involved with the development of phlebitis.

a. Infusates and drugs.
b. Intravenous equipment.
c. Physical condition of the individual.

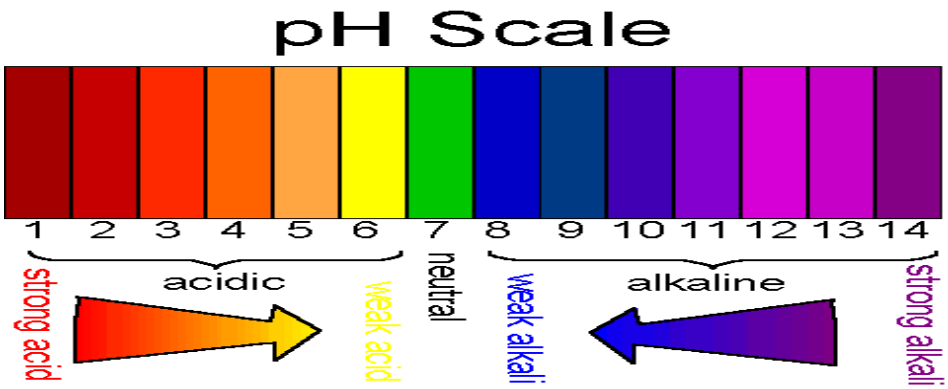
Chemical Phlebitis

Chemical related phlebitis is caused by irritation to the endothelial layer of the vein by the chemical properties of the infusate or drug.

pH

- The pH of infusate may influence chemical phlebitis
- pH is the acidity or alkalinity of a solution as determined by the degree of its hydrogen ion concentration.
- Most intravenous infusates range between pH 3-7. Phlebitis is caused by a too high or too low pH and may be reduced by:
  - Further dilution
  - Infusing at a slower rate

- ❖ Using larger veins



Osmolarity

Chemical phlebitis may also be influenced by the osmolarity of a drug or infusate.

- Osmolarity describes the pressure exerted by all particles per unit of solution. It is expressed as milliosmoles (mOsm) per litre of solution
- Normal serum osmolarity is approximately **280 to 300 mOsm / litre** and is isotonic. This normal isotonic plasma level is used as the standard for comparing the tonicity of IV infusates.
- Infusates with an osmolarity greater than plasma, hypertonic solutions, may cause pain at the insertion site and irritate the endothelial lining of the vein.
- To reduce the potential risk of phlebitis from infusates some drugs need to be reformulated to reduce osmolality. Hypertonic infusates will need to be infused into large central veins.

Isotonic literally translates to *equal solution*. An isotonic cellular environment occurs when an equal solute concentration exists inside and outside the cell. Water molecules flow in and out at an equal rate by osmosis causing the cell size to stay the same. It will not lose or gain any solutes

A hypertonic cell environment has a higher concentration of solutes than in cytoplasm. In a hypertonic environment osmosis causes water to flow out of the cell. If enough water is removed in this way, the cytoplasm will have such a small concentration of water that the cell has difficulty functioning. A solution that has a higher concentration of solutes than that in a cell is said to be hypertonic. This solution has more solute particles and, therefore, relatively less water than the cell contents

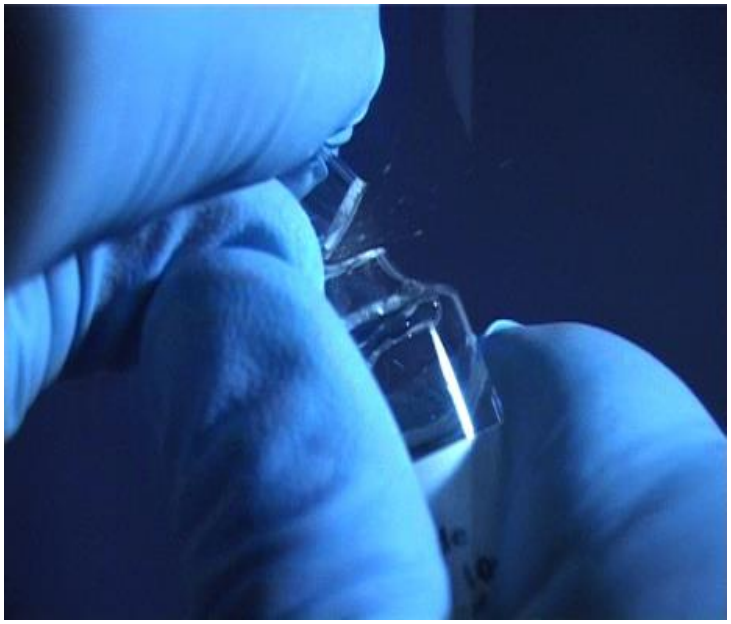
A **hypotonic** cell environment is an environment with a lower concentration of solutes than the cytoplasm of the cell. In a hypotonic environment, osmosis causes water to have net flow into the cell, causing the swelling and expansion of the cell. In summary, a hypertonic solution contains a higher concentration compared to the cell. Hypotonic means it has a lower concentration compared to the cell. Isotonic is a situation in which the concentrations of the cell and of the solution are in an equal ratio.

Hypotonic

Isotonic

Hypertonic

Particulates



Micro-particulate contamination may be caused by glass, rubber, cellulose fibres, plastics, antibiotic crystals and starch powder from gloves.

This can also occur when incompatible solutions are mixed together or infused intravenously and crystallisation occurs. Flushing with normal saline between different drugs will stop this and it is vital to check drug compatibilities before mixing. Never mix solutions together that may cause precipitates.

Particulates induce irritation, vasoconstriction and may cause a neoplastic or sensitising response.

Particulates may travel to the right atrium of the heart, through the tricuspid valve into the right ventricle. From there they travel into the pulmonary artery and branches of arteries until they are trapped in the capillary beds of the lungs. They may also gain access to the systemic circulation. (Weinstein 2001)

Particles as large as 300 micrometres can pass through an 18 gauge cannula. Capillaries in the lungs measure 7-12micrometres in diameter. Occlusion of small arterioles inhibits oxygenation, metabolic activities, cellular activities or may even cause tissue death. (Weinstein 2001)

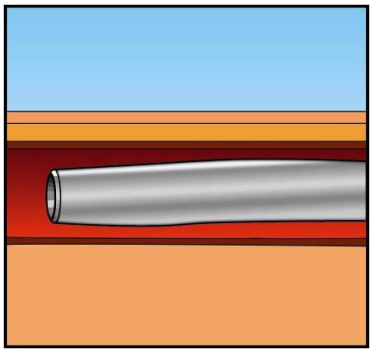
In- line filter and filter needles for drawing up reduce the risk. In the absence of a filter needle, it is recommended to use a blue 23g hypodermic needle which has a small internal lumen so is less likely to pick up particulates.

Mechanical Phlebitis

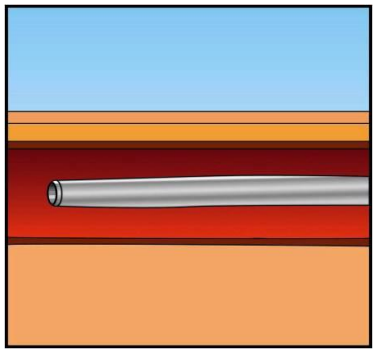
- Mechanical phlebitis represents the second type of phlebitis. It is associated with the cannula itself, its care, size and fixation once inserted.

- A soft flexible material allows the cannula to bend and move with the vein. There are two main types of material used for cannulas – Teflon™ and polyurethane. Cannulas made from a polyurethane material, have been associated with a lower incidence of phlebitis (Stanley 1992)

- Vein-cannula ratio is an important factor. A smaller cannula reduces vein trauma, allows greater blood flow around the cannula allowing infusate to be diluted through haemodilution. A large cannula can occlude blood flow (Campbell 1998)



Poor vein to cannula ratio



Good vein to cannula ratio

- Good site selection with secure fixation techniques reduces unnecessary movement.

- The length of time a cannula is in place should be within the local policy. This is usually within 48-72hrs. (DHSS 1972 cited Wilson 1994). (Winning Ways 2003)

Other factors:

Physical condition of the individual having a cannula inserted may influence all three types of phlebitis. For example chronic diseases may influence in the following ways:

- Diabetes

The secondary condition of peripheral neuropathy destroys peripheral nerve endings, this loss of sensation may prevent an individual from noticing if the site has become tender.

- Cancer

Individuals receiving chemotherapy experience a decreased white blood cell and platelet count, which may be associated with increased risk of infection.
Also their veins can be very frequently used for access and become very fragile and inflamed.

- Immunosuppressed

Individuals may exhibit delayed signs and symptoms of infection, if at all.

- Mastectomy

If an individual has had lymph tissue removed there is an increased risk of infection and swelling in the affected side. Research has suggested that to interfere with this arm can also worsen lymphoedema.

- Presence of an infection

In some cases the external surface of the catheter tip becomes colonized by bacteria circulating in the blood from another focus (e.g. the respiratory or urinary tract.) This is called haematogenous seeding. The bacteria may then multiply on the catheter tip and subsequently cause a catheter associated infection.

- Age

Elderly adults and young children have been shown to be prone to phlebitis development as their risk factor is raised by having an invasive device in place.
Children's veins are small and fragile, whilst their skin presents challenges by being thin or having a substantial layer of fat, depending on their age. .
The elderly will experience changes in both their skin and intima as they age, which results in much more motile veins which are less flexible and potentially harder to access

- Skin condition

Intact skin is very important as it is the barrier to infection. It also needs to be robust as it needs to tolerate a dressing which will hold the cannula in place.
Broken skin should be avoided as it is sore and difficult to disinfect and may not be such a good infection barrier or tolerate a dressing.

- Nutritional state

Any patient who is on less than a full diet and may also be unwell has been shown to be more susceptible to phlebitis. As protein supplies are the building blocks for recovery, a patient whose intake is lower is much less robust.

Monitoring phlebitis

- It is essential to observe cannulas and monitor the incidence of phlebitis and ensure minimal complications, prompt treatment and implementation of procedures to prevent phlebitis occurring.

- There are many scales that may be used to assist the practitioner. E.g. Maddox 1977, Jackson 1997, Chelsea and Westminster 2000.

- All checking and monitoring should be performed in accordance with local policies.

Catheter Related Blood Stream Infection

- Infection is the third area of phlebitis risk. It may be reduced by strict adherence to infection control procedures.

- Following cannula insertion fibrin will sheath the cannula within 24-48 hrs. This forms a nidus in which micro-organisms may multiply, if present, shielding them from the host's defences and antibiotics.

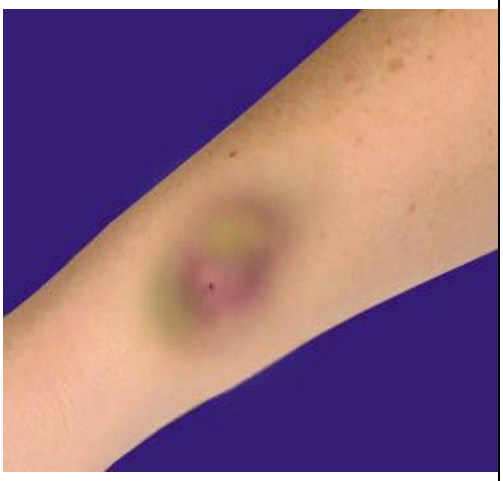
- A nidus is defined as a central point or focus of bacterial growth in a living organism.

- A cannula infection can be identified by signs of phlebitis, pyrexia and a general feeling of being unwell. On blood test, results a raised white blood cell count may be observed.

- Prompt management of suspected cannula infection will prevent further serious complications such as septicaemia.
    - Remove the cannula immediately and send tip for culture and sensitivity.
    - Inform medical team and implement treatment plan.
    - Resite new cannula and continue therapy as prescribed.

- The Pathology Unit requires needs blood cultures to be sent with the tip for comparative purposes. This may involve one or a series of cultures sets.

Haematoma

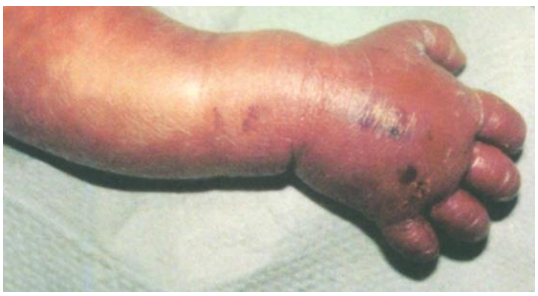


- A haematoma is a collection of blood that clots to form a solid swelling (Oxford Concise Medical dictionary 1989). It is formed by a leakage of blood around the insertion site or following removal.
- To reduce the risk and ensure good venous filling, select veins that are clearly defined. Maintain pressure following removal for at least one minute ensuring bleeding has stopped
- Once a haematoma has occurred it restricts site availability and may be painful and unsightly.

Transfixation

- Transfixation occurs during the insertion procedure. The cannula has entered the vein and continued through the other side. Flashback of blood will have occurred because the cannula has passed through the vein, but does not continue.
- This may be reduced by lowering the angle of the cannula after initially puncturing the vein before advancing the cannula. Flushing the cannula immediately after insertion confirms the correct location of the cannula in the vein.

Infiltration



- Infiltration occurs when the cannula has dislodged allowing fluid to enter the surrounding tissues. The area may be cool to touch and oedema present. If

hypertonic, alkaline or cytotoxic solutions have infiltrated, tissue necrosis may occur. This is referred to as extravasation.

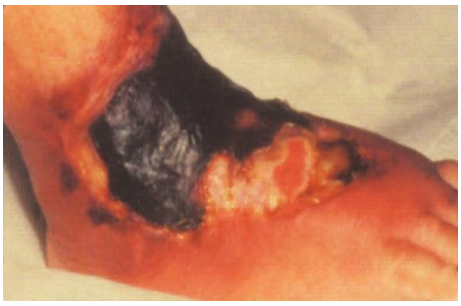
- An individual may be deprived of fluid and drug absorption at a rate for successful therapy from infiltration. Infiltration limits available veins and predisposes the individual to infection.

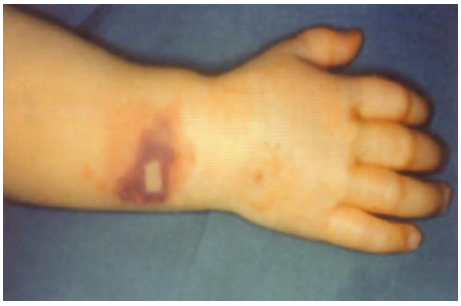
- To reduce the risk, flush the cannula after insertion, before and after administering fluids and drugs. Use a flexible cannula and good fixation methods. Maintain regular observation of cannula site and infusion in accordance with local policy.

- A tourniquet applied proximal to the cannula will restrict venous flow . If the infusion continues, infiltration is evident

Extravasation

- Extravasation is linked to infiltration where tissue necrosis has occurred. A drug or infusate enters the subcutaneous tissue by accident and is likely to cause tissue damage unless action is taken.





- Damage can also be caused to nerves, tendons and joints.
- If superficial tissue loss occurs and remains free of infection, debridement will yield a clean bed capable of granulating. If deep structures are involved wide excision, debridement, grafting and amputation may be necessary (Weinstein 2001).
- Extravasation may continue even after the cannula has been removed. Some drugs are found to be still bound to tissue DNA months later.

Risks can be reduced by:

A) Extravasation protocols:
- Familiarity with policy and procedure
- Calling Pharmacist to ask for advice - immediately
- Protective clothing / equipment
- Immediate action

B) Education of all staff:
- Drugs likely to cause extravasation
- Use of devices and syringe pumps
- Site selection
- Detection, management and treatment
- Reporting via accident / incident system (IR1)

C) Extravasation kits:
- Location of kits
- Contents of kits
- Possible antidotes
- Ice packs / heat packs

- Out of hours locations

- Management of extravasation must be prompt to reduce further damage. If treatment is delayed, surgical debridement, skin grafting and amputation may be needed.

- Reporting of injuries or near misses is the role of the Pharmacist. A "Green Card" system exists where reports are sent to a central body in Birmingham called the National Extravasation Information Service. All results are collated and guidelines are then issued to try to improve safety linked to drugs and infusates at high risk of causing further injuries.

At risk groups diseases / conditions include:

❖ <u>Cancer</u>

Veins of people receiving chemotherapy are often fragile, mobile and difficult to cannulate.

Patients who have had an extravasation and receive future chemotherapy given at a site may experience tissue damage at the original site. ("Recall phenomenon")

Radical mastectomy, axillary surgery or lymph node dissection may impair circulation in the limb, causing reduced venous flow and pooling and potential leakage of infusates around the site of cannulation.

❖ <u>Peripheral vascular disease</u>

Atherosclerosis may reduce venous flow with risk of leakage at the intravenous site

Patient may also be debilitated with reduced venous and tissue tone.

❖ <u>Raynaud's Phenomenon</u>

Arterial spasm may compromise peripheral circulation and reduce venous flow

❖ <u>Diabetes</u>

Patients with peripheral neuropathy may not feel the pain of an extravasation.

Signs and Symptoms include:

Initially:

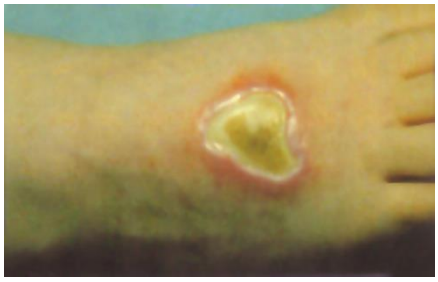
- Burning, itching or stinging at the site
- Erythema, swelling and tenderness.
- Sensation of heat or coolness around the site

After some time:

- Blistering of the skin
- Mottling or darkness of the skin
- Persistent pain at the site which can indicate that a more severe injury has occurred.

Long term damage:

- Induration suggests ulceration will occur
- When full thickness of skin is damaged, skin may be very white and cold with no capillary filling.
- After a period of time, may develop a black, dry eschar.
- Eschar will slough to reveal an underlying ulcer cavity.
- Surgical excision and /or skin grafting may be needed.



High risk sites

- Dorsum of hand or foot
- Ankle
- Antecubital fossa
- Near joints
- Joint spaces
- Limbs with vascular problems, such as lymphoedema
- Peripheral cannulations
- Previous sites of radiotherapy

Risk factors

- Majority occur at night and go unnoticed
- Multiple cannulation attempts may create risk of leakage of the drug
- Lack of familiarity with the nature of the drug or the group of patients
- Covering the site with occlusive dressing may hide an extravasation
- Use of high pressure pumps as opposed to volumetric pumps.
- Steel needles cause more episodes then flexible plastic

Air Embolism

- Air embolism is a possible complication in intravenous therapy. During cannula insertion this is limited by positive peripheral venous pressure (3-5cm H2O). Negative pressure may occur if the site selected is elevated above heart level.
- Air must be removed from all connectors and lines before attaching to the cannula. All connectors must be luer lock type.
- The clinician must be aware of the symptoms associated with the occurrence of air embolism. This will ensure prompt and effective treatment. They are as follows:
    - Sudden vascular collapse
    - Cyanosis
    - Hypotension
    - Weak, rapid pulse
    - Increased central venous pressure.
- The clinician must turn the individual onto their left side, with head down (Trendelenburg position).
- Medical team must be informed immediately
- 100% oxygen
- Attempt aspiration of air if Central Venous Catheter is in place
- Support right ventricular function with intravenous fluids.

Q. **How does positioning in this way help?**

A. It causes air to rise into the right atrium, preventing it from entering the pulmonary artery.

Cannula Embolism

- Cannula embolism occurs when a fragment of cannula has broken off and should not occur if the correct insertion procedure is followed. **The stylet must never be re-introduced** when the cannula has entered the vein. This may cause a fragment of cannula to break off and enter the circulatory system.

Shearing of catheter tip caused by reinsertion of a needle. The distal fragment may completely fracture and cause embolization. Once a needle is removed from a catheter, it should never be reinserted.

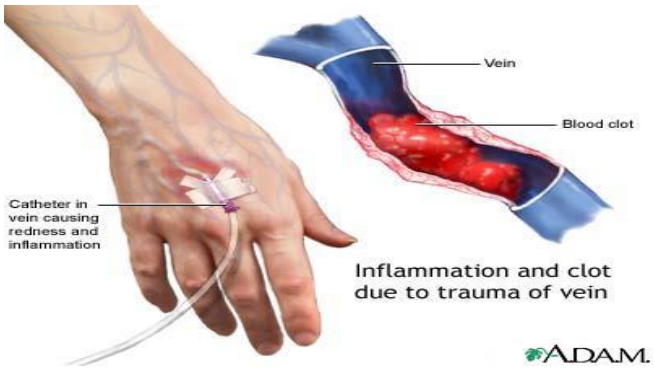
Thromboembolism

- Thromboembolism occurs when a blood clot on the cannula or vein wall is carried by the venous flow to the heart and pulmonary circulation.

- Where the cannula enters the vein, trauma will occur. Thrombi form on the vein around the cannula and at its tip, following insertion.

- Using small gauge cannula may reduce this, allowing blood flow around the cannula. Avoid using veins in the lower extremities because of reduced venous return.

Thrombophlebitis



Definition:

- Thrombophlebitis involves inflammation of a vein caused by a blood clot inside. With superficial thrombophlebitis, the clot is in a vein just below the surface of the skin.
- Superficial thrombophlebitis may occur after the recent use of an intravenous (IV) line, after trauma to the vein, or for no apparent reason in persons at risk for thrombophlebitis.

Risks for superficial thrombophlebitis include the following:

- Disorders that involve increased blood clotting
- Infection
- Varicose veins
- Chemical irritation of the area
- Being immobilized for a prolonged period

Signs and symptoms:

- Skin redness or inflammation along a superficial vein
- Warmth of tissue around a superficial vein
- Tenderness or pain along a superficial vein (worse when pressure is applied)
- Pain in limb
- Hardening of a superficial vein (induration) -- the vein feels cord-like

Diagnosis:

- Doppler ultrasound
- Duplex ultrasound
- Venography

If infection is suspected, cultures of the skin or blood cultures may be performed.

Treatment is to reduce pain and inflammation plus reduce complications

- Remove cannula and resite in an alternative place if needed.
- Analgesics for pain
- Non steroidal anti-inflammatory drugs (NSAIDs) to reduce inflammation
- Intravenous anticoagulants followed by oral anticoagulants to reduce the likelihood of clotting
- Consider elevation of limb but do not immobilise, encourage movement
- Antibiotics are prescribed if infection is present.
- Surgical removal (phlebectomy), stripping, or sclerotherapy of the affected vein are occasionally needed

Prognosis:

Superficial thrombophlebitis is usually a benign and short-term condition. Symptoms generally subside in 1 to 2 weeks, but hardness of the vein may remain for much longer.

Speedshock/Overload

- The administration of medication and/or infusion should be performed over the specified time in order to prevent the development of speedshock and fluid overload
- The nurse administering the medication and/or infusion should have the knowledge of the speed or rate over which to perform the administration
- She/he must be able to prevent the occurrence and recognise the signs and symptoms of speed-shock and overload
- Should either occur, the nurse must be able to act accordingly and the doctor should be notified

Overload

Hypervolaemia, or **fluid overload**, is the medical condition where there is too much fluid in the blood. If intravenous fluid is infused in too fast and the patient's renal function is unable to balance and remove fluid at a safe rate, this may result.

Symptoms

The excess fluid, primarily salt and water, builds up in various locations in the body and leads to an increase in weight, swelling in the legs and arms (peripheral edema), and / or fluid in the abdomen (ascites).

Eventually, the fluid enters the air spaces in the lungs, reduces the amount of oxygen that can enter the blood, and causes shortness of breath (dyspnoea).

Fluid can also collect in the lungs when lying down at night, possibly making night time breathing and sleeping difficult (paroxysmal nocturnal dyspnoea).

Complications

Congestive heart failure is the most common result of fluid overload. Also, it may cause hyponatraemia (low sodium)

Treatment

- Immediately call for medical assistance
- Observations and SOS score
- Sit patient up
- Oxygen – aim for a saturation rate of 95% and above
- Diuretics (intravenous furosemide)
- Accurate fluid balance using urinary catheterisation for output

Diagnosis

1. Blood tests:

    - U&Es, creatinine, sodium, potassium, glucose, cardiac enzymes, liver function tests, clotting tests (INR)
    - Arterial blood gases and pH

2. ECG: look for evidence of arrhythmia, myocardial infarction or other cardiac disease, e.g. left ventricular hypertrophy.
3. Chest X-ray: to exclude other causes of breathlessness and confirm pulmonary oedema.
4. Echocardiogram: ESC guidelines suggest that all patients with AHF should be evaluated with echocardiogram as soon as possible, as it frequently determines treatment strategy.[5]
5. Non invasive monitoring: body temperature, respiratory and heart rate, urine output, pulse oximetry and ECG telemetry, daily weights.
6. A urinary catheter enables accurate measurement of urinary output which helps rapidly to assess diuretic response and fluid balance.
7. More invasive monitoring required for intensive support, including arterial and central venous pressure lines and pulmonary artery catheters.

Speed shock

A sudden adverse physiologic reaction to IV medications or drugs that are administered too quickly. This causes shock to the vital organs as there is insufficient blood to dilute the solution and a toxic state ensues.

Some signs of speed shock are:

- flushed face
- pounding headache
- hypertension
- a feeling of apprehension
- chills
- a tight feeling in the chest

- irregular pulse
- loss of consciousness
- cardiac arrest.

Treatment

- Call for medical team immediately
- CPR or intensive support
- Oxygen
- Urinary catheterisation for accurate fluid balance
- Observations including SOS and Glasgow Coma Scale recordings

Care and Maintenance

Key principles for preparation and administration of drugs and infusions

- Following successful peripheral cannulation, care and maintenance of the cannula becomes an essential component preventing potential complications and ensuring the safe administration of intravenous fluids, blood, blood products and medications.

- Clear standards and policies ensure methods implemented are updated and researched based. This ensures the comfort, compliance and safety of the individual is always maintained.

- There are important key principals to follow in the preparation and administration of intravenous fluids and medications that will prevent potential complications, ensuring the cannula continues to function correctly and therapy is achieved safely.

- All procedures for checking and preparation must be accordance with local policy and prescriptions. Information can be obtained from pharmacy departments, BNF, local formulary and instruction leaflets.

- Individuals past history including clinical condition, allergies any anxieties, which may influence successful administration, must be reviewed prior to commencing therapy.

- All intravenous fluid containers must be inspected, checking fluid is clear, bag dry and intact. Expiry date checked and lot number recorded in individuals records.

- Hand washing and aseptic non-touch technique must be implemented throughout the procedure.

- Medications added to infusions must be prescribed and added using aseptic technique, mixed thoroughly before connection and containers labelled.

- Compatibility of the medications must be checked with infusion fluid.

- Blood must be administered within thirty minutes of leaving the bank. No medication or intravenous fluids can be administered through the same administration set.

Principles involved in line manipulation and line changes

- To ensure safety, the optimum performance and longevity of a peripheral cannula the practitioner must choose the correct equipment for the therapy.

- When administering intravenous fluids the correct giving set must be used. Standard giving sets without a filter can be used for fluids. Infusions containing drugs must be giving through the correct pump or burette. Blood and blood products through a set with an integral filter, platelets though a special set

- When choosing an infusion device it must be in accordance with local policy. The Medicines and Healthcare Products Agency (MHRA) has recommendations in order for the user to make the appropriate choice.

- In-line filters can be used to prevent particulate and bacteria entering the system. They must be used in accordance with local policy.

- The connecting and changing of giving sets is an aseptic procedure and one must also adopt universal precautions (see infection control module for further information). Cannula allows bypassing of the body's natural defences i.e. the skin. This increases the risk of nosocomial infection, a hospital acquired infection.

- The set must be primed to remove all air. The protective cap at the end must remain *in situ* until ready for attachment.

- When attaching the set place the arm on a sterile field, wearing gloves loosen the cap at the end of the cannula applying pressure beyond the tip to reduce blood flow. Attach the giving set end having removed the cap, and luer-lock into position. All connections must be luer-lock.

- The giving set must be secure to prevent accidental removal or dislodgement. Also ensuring the comfort of the individual. This may be achieved by taping. Position the tubing so that it is not pulling. Apply the tape and pinch over the tubing to prevent from pulling through (Dougherty and Lamb 1999).

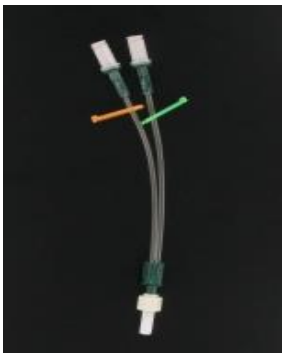
- Giving sets must be labelled with date and time and changed every 48-72hours in accordance with local policy. Every 12hrs for blood (RCN 2005) and 24hrs for those with medication added (Dougherty and Lamb 1999).

Add-on devices (needlefree access devices)

Vygon Bionector™

With rigid protective non-touch applicator, to ensure aseptic connection.
Distal end: male Luer-lok™, proximal end: female Luer-lok™.

- Needle free access device, low risk linked to accidental needletick injury.
- Easy to de-contaminate using an alcohol based disinfectant.
- GWHNHSFT recommends Sanicloth™ or Clinell™ wipes 70% alcohol and 2% Chlorhexidine. Swab for 30 seconds and allow to air dry for approx 30 seconds.
- Maximum in-dwell time 7 days or 100 activations, whichever comes sooner
- High flow rates can be achieved.
- Suitable for both luer-lok™ or luer-slip syringes
- Available in a variety of versions to allow for multiple access points, if required.
- Octopus™ are multi-lumen extension tubes made of soft transparent polyurethane with a very low priming volume. They allow several lines to be independently connected to the I.V catheter.



Dressings

- Dressings have three main requirements. They must protect the puncture site, hold the cannula in place and keep the site clean. These features will reduce

the potential risk of phlebitis, infection, accidental removal and provide a comfortable cannula site for the individual.

- The clinician must be confident in applying a cannula dressing without touch contamination or accidental removal of the cannula. There should be no need to change the dressing until the cannula is removed as long as it is not soiled and the cannula can be visualised.

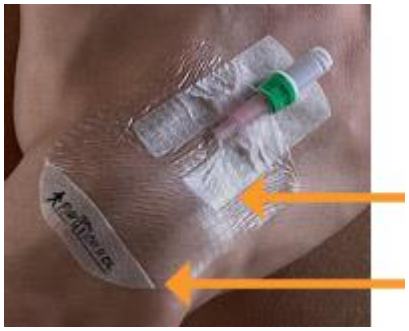
- Cannula dressing should be sterile, semi-permeable, allow for vision of the insertion site, and have capability for the dressing to be endorsed re: insertion date etc.

The two dressings below are recommended for use in this Trust. IV3000 is very broadly used and Tegaderm is used in specialist areas such as ICU, SCBU and Childrens' Ward.

smith&nephew

IV3000™ dressing

In addition to the benefits that the **IV3000** 1-Hand dressing range currently offers clinicians, **IV3000** 1-Hand now offers improved fixation and a documentation label.



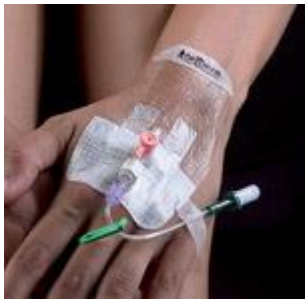
2 sterile securing strips provide additional fixation

Documentation label means best practice can be adopted

The patented **Reactic*** film used to make **IV3000** has a unique molecular structure which is significantly more permeable to water vapour than ordinary films. This prevents the accumulation of moisture underneath the dressing, reducing bacterial growth and the risk of catheter-related infection.
The higher permeability of **IV3000** keeps the skin drier, improving dressing adherence and reducing the number of unscheduled dressing changes.

IV3000 is transparent and so allows regular inspection of the catheter insertion site for signs of infection or phlebitis without the need for dressing removal.

IV3000 provides greater patient comfort



IV3000 is kind to the patient's skin. Its low allergy adhesive and highly permeable **Reactic** film help prevent skin maceration or irritation and result in improved patient comfort.
The unique grid pattern adhesive makes dressing removal easier than with ordinary films. It reduces pain on removal and leaves less adhesive residue on the patients skin.
The highly conformable **IV3000** film allows the patient to move freely and yet will remain firmly adhered around the catheter hub so ensuring excellent fixation.
IV3000 is waterproof and allows the patient to shower with the dressing in situ.

3M

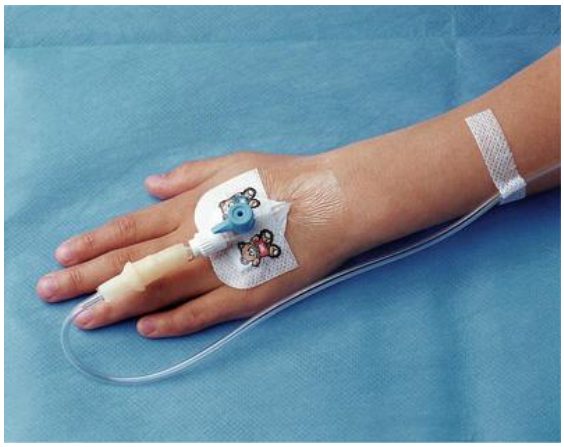
Tegaderm IV dressings™

Transparent film dressings designed to secure the catheter in challenging I.V. applications. Many with notches and borders reinforced with a soft cloth

fabric, designed to reduce edge lift and to seal around the insertion site.

Tegaderm™ I.V. Film has a "frame" delivery system. Sterile soft cloth tape strips are also provided with many dressing for anchoring hubs, lumens and tubing. Dressings are waterproof and latex-free.

Tegaderm™ paediatric 1610 IV dressing



The first I.V. dressing with the paediatric patient in mind.

The Tegaderm™ I.V. 1610 Paediatric Dressing is 5 x 5.7cm in size making it more suitable for paediatric use than many larger conventional products. It contains 3M`s recognised Tegaderm transparent film to protect the site and allow observation of the catheter entry point. In addition, the product includes soft cloth reinforcement and Medipore tape strips for added security. Friendly pictures of teddy bears (Tegabears) on the surface of the dressing are designed to allay a child`s fears encouraging them to keep the dressing in place.

Product Benefits

- Transparent film over insertion site allows easy skin and site monitoring
- Two sterile soft cloth tape strips help to anchor catheter and infusion lines
- Waterproof to protect against external contamination
- Deep notch design seals around catheter to protect puncture site
- Design prevents 'tenting' of dressing and 'stick-to-itself' wastage
- Fun 'Tegabear' design for improved patient compliance
- This product and package do not contain natural rubber latex

Correct method for flushing peripheral cannula

Flushing **peripheral cannulae** is an essential part of the care and maintenance of a cannula for the following reasons:

a) Checking the cannula is correctly positioned in the vein following insertion.
b) Checking the cannula is patent and in the vein prior to adminstration of intravenous fluids, medication or blood and blood products.
c) Prevent the mixing of incompatable solutions leading to potential interactions.
d) Ensuring entire volume of the drug has entered the vein.
e) Prevent cannula occlusion.

- There have been many studies examining the use of saline flushes versus heparin. Saline 0.9% has been found to be as effective as heparin in adults. The use of saline 0.9% avoids the risk of side effects of heparin such as thrombocytopenia and allergic reactions (Randolph et al 1998) or incompatability with other medications.

- **NB: the following procedure and guidelines are for adults. Although the procedure may be similar for paediatrics the volumes and equipment may vary.**

- The amount of Sodium Chloride 0.9%, syringe size, frequency and flushing technique must be clear and local policies adhered to. A general guide would be as follows:

a) 5ml syringe of Sodium Chloride 0.9% is sufficient. 2ml before and 3 ml after administration of medication (Dougherty and Lamb 1999).

b) Flushing every eight to twelve hours for patency. Before and after any transfusion or administration of medication.

c) A positive pressure technique is recommended to prevent backflow of blood into the cannula, which may clot and form a blockage.

Positive pressure can be achieved in two ways:

i) Maintaining pressure on the syringe plunger, while withdrawing the syringe.
ii) Using a closed system with a positive pressure valve. For example Bionector.

d) Prefilled syringes may be beneficial for flushing. Reducing the risk factors associated with microbial contamination of manually filled syringes (Worthington et al 2001).

Monitoring, Measuring and Recording Complications

- To ensure best practice for care and maintenance of peripheral cannulae, it is essential to keep accurate data of complications. For example the rate of phlebitis in local area compared with national rates. This allows issues to be addressed and a continual learning curve to be made. They can also support good practice.
- Local standards policies and procedures must be in place to support the practitioner and ensure the individuals well being. These must include training and assessment with support from experienced practitioners.
- It is essential the care, maintenance and monitoring of the cannula are documented regularly in the individual records in accordance with local policy. Documentation is the record showing care has taken place

Name: Unit No: NHS No:

Great Western Hospitals NHS
NHS Foundation Trust

Peripheral Line Record

Cannula 1: Inserted by:	Number of attempts:
Date & time of insertion:	Site of insertion:
Ward / Department:	Size / Colour:
Date & time of removal:	VIP Score on removal:
Name & signature of person removing cannula:	
Cannula 2: Inserted by:	Number of attempts:
Date & time of insertion:	Site of insertion:
Ward / Department:	Size / Colour:
Date & time of removal:	VIP Score on removal:
Name & signature of person removing cannula:	

Reasons for Insertion

1. IV Fluids	2. IV Medication	3. Blood Transfusion	4. Procedure within 24 hrs	5. Other

Cannula 1	Date & time	VIP Score	Dressing dated & intact	Reason for insertion	IV line dated	Signed
Day 1 : a.m.						
p.m.						
Day 2 : a.m.						
p.m.						
Day 3 : a.m.						
p.m.						
Remove cannula unless poor venous access						
Day 4 : a.m.						
p.m.						
Day 5 : a.m.						
p.m.						

Cannula 2	Date & time	VIP Score	Dressing dated & intact	Reason for insertion	IV line dated	Signed
Day 1 : a.m.						
p.m.						
Day 2 : a.m.						
p.m.						
Day 3 : a.m.						
p.m.						
Remove cannula unless poor venous access						
Day 4 : a.m.						
p.m.						
Day 5 : a.m.						
p.m.						

Authors: P.Hanlon & V.Taylor IP&C Unscheduled Care Directorate July 2009

evaluation record.

Date & time	Evaluation record	Signed

Visual Infusion Phlebitis Score (VIPS) Record score overleaf twice daily (Jackson 1997)			
Observation	**Score**	**Description**	**Action**
IV site appears healthy. No pain	0	No signs of phlebitis	Observe cannula
One of the following is evident: • Slight pain near IV site **Or** • Slight redness near Iv site	1	Possible first signs of phlebitis	Observe cannula
Two of the following are evident: • Pain at IV site • Redness • Swelling	2	Early stage of phlebitis	Resite cannula
All the following signs are evident: • Pain along path of cannula • Redness • Induration	3	Medium stage of phlebitis	Resite cannula Consider treatment
All the following signs are evident & extensive: • Pain along the path of the cannula • Redness • Induration • Palpable venous cord	4	Advanced stage of phlebitis or thrombophlebitis	Resite cannula Consider treatment Complete IR1
All the following signs are evident & extensive: • Pain along the path of the cannula • Redness • Induration • Palpable Venous cord • Pyrexia	5	Advanced stage of thrombophlebitis	Initiate treatment Resite cannula Complete IR1

Great Western Hospitals NHS
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Incident management policy

Appendix 1 – Minor incidents: quick reference guide

Part 1: Reporting

Serious incidents (immediate action)

The priority is always to make the area safe for patients, staff and visitors. Once safe, it is important that the appropriate teams are contacted ASAP

Incident	Contact
Sharps Injury	4472
RIDDOR	OH&S Dept
Serious Clinical Incidents	Clinical Risk
Equipment (MHRA)	Trust Equipment
Serious reaction to transfusion	Blood Transfusion Practitioner
Falls	Falls Avoidance Nurse
Infection	IP&C Team
Serious medication incident	Pharmacy

The remainder of this guidance is aimed at staff investigating less serious or 'minor' incidents.

Why report incidents?

To facilitate learning and in so doing promote a safer environment for patient, staff and visitors. In many cases it is a legal requirement to report incidents. All incidents are anonymised and forwarded to the National Patient Safety Agency (NPSA) to facilitate national learning.

What is reportable?

Any event or near miss that could or did lead to harm to one or more people, damage to plant, buildings or equipment, or damage to operational effectiveness or reputation of the organisation.

How to report incidents

Complete an electronic incident report form on the Trust Intranet site, report electronically wherever possible. If you are unable to report electronically complete an IR1

- **blue** copy to manager;
- **pink** copy send to H&S within 24hrs;

- **grey** copy stays in book.

Part 2: Investigation

Who should investigate?

Ensure you are familiar with your local arrangements for the investigation of incidents. Minor incidents may be investigated by:

- a line manager;
- a designated local investigator (e.g. an H&S rep).

It is important that the investigator has a basic understanding of incident investigation (use of this guide is recommended)

Basic Elements of the Investigation

You need to ask 6 questions**:**

- **Who** was involved?
- **What** happened?
- **When** did the incident occur?
- **Where** did the incident occur?
- **How** did the incident occur?
- **Why** did the incident occur*?*

NPSA Contributory Factors

- Patient factors
- Individual factors
- Task Factors
- Communication Factors
- Team Factors
- Education and Training
- Equipment
- Work and Environment Factor
- Organisational Factor

Document Your Investigation

Your investigation should be summarised on the electronic manager's form or on the IR2. Investigators should take care to identify any further action needed to prevent recurrence and also be clear what is required, by when and who is responsible for implementing the improvements required.

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Emergency Treatment of Anaphylatic Reactions

Definition:

Definition of anaphylaxis

A precise definition of anaphylaxis is not important for the emergency treatment of an anaphylactic reaction. There is no universally agreed definition. The European Academy of Allergology and Clinical Immunology Nomenclature Committee proposed the following broad definition: [11]

Anaphylaxis is a severe, life-threatening, generalised or systemic hypersensitivity reaction.

This is characterised by rapidly developing life-threatening airway and/or breathing and/or circulation problems usually associated with skin and mucosal changes.

Epidemiology

One of the problems is that anaphylaxis is not always recognised, so certain UK studies may underestimate the incidence. Also, as the criteria for inclusion vary in different studies and countries, a picture has to be built up from different sources.

Incidence rate

The American College of Allergy, Asthma and Immunology Epidemiology of Anaphylaxis Working group summarised the findings from a number of important international epidemiological studies and concluded that the overall frequency of episodes of anaphylaxis using current data lies between 30 and 950 cases per 100,000 persons per year.[12]

Lifetime prevalence

The same group provided data indicating a lifetime prevalence of between 50 and 2000 episodes per 100,000 persons or 0.05-2.0%.[12] More recent UK primary care data concur, indicating a lifetime age-standardised prevalence of a recorded diagnosis of anaphylaxis of 75.5 per 100,000 in 2005.[13] Calculations based on these data indicate that approximately 1 in 1,333 of the English population have experienced anaphylaxis at some point in their lives.

Other data

A retrospective study of Emergency department attendances, identifying only the most severe cases, and relating this number to the population served, estimated that approximately 1 in 3,500 patients had an episode of anaphylaxis during the study period 1993-4.[14] Taking specific causes of anaphylaxis where prevalence and

severity data are available, there are 1 million cases of venom anaphylaxis and 0.4 million cases of nut anaphylaxis up to age 44 years worldwide.

Triggers

Anaphylaxis can be triggered by any of a very broad range of triggers, but those most commonly identified include food, drugs and venom.[15] The relative importance of these varies very considerably with age, with food being particularly important in children and medicinal products being much more common triggers in older people.[16] Virtually any food or class of drug can be implicated, although the classes of foods and drugs responsible for the majority of reactions are well described.[17] Of foods, nuts are the most common cause; muscle relaxants, antibiotics, NSAIDs and aspirin are the most commonly implicated drugs (Table 1). It is important to note that, in many cases, no cause can be identified. A significant number of cases of anaphylaxis are idiopathic (non-IgE mediated).

Suspected triggers for fatal anaphylactic reactions in UK 1992 to 2001

(Pumphrey RS. Fatal anaphylaxis in the UK, 1992- 2001. Novartis Foundation Symposium 2004; 257;116-28)

Stings	47	29 wasp, 4 bee, 14 unknown
Nuts	32	10 peanut, 6 walnut, 2 almond, 2 brazil, 1 hazel, 11 mixed or unknown
Food	13	5 milk, 2 fish, 2 chickpea, 2 crustacean, 1 banana, 1 snail
? Food	18	5 during meal, 3 milk, 3 nut, 1 each – sherbert, fish, yeast, nectarine, grape, strawberry
Antibiotics	27	11 penicillin, 12 cephalosporin, 2 amphoteracin, 1 ciprofloxacin, 1 vancomycin
Anaesthetic drugs	35	19 suxamethonium, 7 vercuronium, 6 atracurium, 7 at induction
Other drugs	15	6 NSAID, 3 ACE Inhibitors, 5 gelatins, 2 protamine, 2 vitamin K. 1 each – etoposide, diamox, pethidine, local anaesthetic, diamorphine, streptokinase.
Contrast media	11	9 iodinated, 1 technetium, 1 flourescine
Other	4	1 latex, 1 hair dye, 1 hydatid, 1 idiopathic

NSAID – Non steroidal anti-inflammatory drug
ACEI – Angiotensin Converting Enzyme Inhibitor

Mortality

The overall prognosis of anaphylaxis is good, with a case fatality ratio of less than 1% reported in most population-based studies.[18-20] Risk of death is, however, increased in those with pre-existing asthma, particularly if the asthma is poorly controlled or in those asthmatics who fail to use, or delay treatment with, adrenaline.[21]

There are approximately 20 anaphylaxis deaths reported each year in the UK, although this may be a substantial under-estimate.

Risk of recurrence

The risk of an individual suffering recurrent anaphylactic reaction appears to be quite substantial, being estimated at approximately 1 in 12 per year.[22]

Trends over time

There are very limited data on trends in anaphylaxis internationally, but data indicate a dramatic increase in the rate of hospital admissions for anaphylaxis, this increasing from 0.5 to 3.6 admissions per 100,000 between 1990 and 2004: an increase of 700% (Figure 1).[23 24]

Time course for fatal anaphylactic reactions

When anaphylaxis is fatal, death usually occurs very soon after contact with the trigger. From a case-series, fatal food reactions cause respiratory arrest typically after 30–35 minutes; insect stings cause collapse from shock after 10–15 minutes; and deaths caused by intravenous medication occur most commonly within five minutes. Death never occurred more than six hours after contact with the trigger (Figure 2).[25]

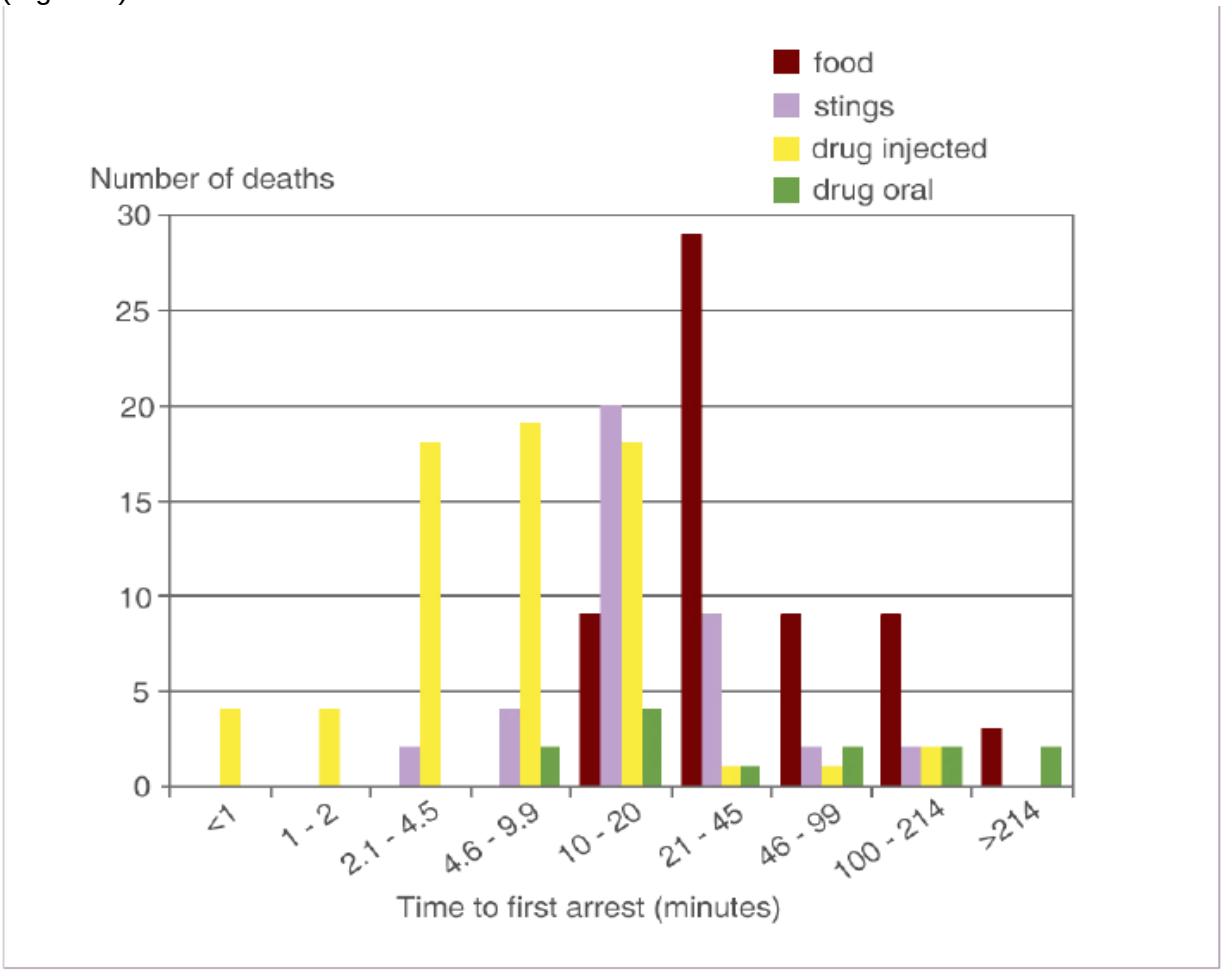


Figure 2. Time to cardiac arrest following exposure to triggering agent [25]

A diagnosis of anaphylactic reaction is likely if a patient who is exposed to a trigger (allergen) develops a sudden illness (usually within minutes of exposure) with rapidly progressing skin changes and life-threatening airway and/or breathing and/or circulation problems. The reaction is usually unexpected.

The lack of any consistent clinical manifestation and a range of possible presentations cause diagnostic difficulty. Many patients with a genuine anaphylactic reaction are not given the correct treatment.[26] Patients have been given injections of adrenaline inappropriately for allergic reactions just involving the skin, or for vasovagal reactions or panic attacks.[4] Diagnostic problems have arisen particularly in children. Guidelines for the treatment of an anaphylactic reaction must therefore take into account some inevitable diagnostic errors, with an emphasis on the need for safety.

A single set of criteria will not identify all anaphylactic reactions. There is a range of signs and symptoms, none of which are entirely specific for an anaphylactic reaction; however, certain combinations of signs make the diagnosis of an anaphylactic reaction more likely.[27] When recognising and treating any acutely ill patient, a rational ABCDE approach must be followed and life-threatening problems treated as they are recognised

3.1 Anaphylaxis is likely when all of the following 3 criteria are met:

- Sudden onset and rapid progression of symptoms
- Life-threatening Airway and/or Breathing and/or Circulation problems
- Skin and/or mucosal changes (flushing, urticaria, angioedema)

The following supports the diagnosis:

- Exposure to a known allergen for the patient

Remember:

- Skin or mucosal changes alone are not a sign of an anaphylactic reaction
- Skin and mucosal changes can be subtle or absent in up to 20% of reactions (some patients can have only a decrease in blood pressure, i.e., a Circulation problem)
- There can also be gastrointestinal symptoms (e.g. vomiting, abdominal pain, incontinence)

Pseudo-anaphylaxis

Confusion arises because some patients have systemic allergic reactions that are less severe. For example, generalised urticaria, angioedema, and rhinitis would not be described as an anaphylactic reaction, because the life-threatening features –- an airway problem, respiratory difficulty (breathing problem) and hypotension (circulation problem) –- are not present.

The presentation and treatment of pseudoanaphylaxis is similar to that of anaphylaxis. It however does not involve an allergic reaction but is due to direct mast cell degranulation. This can result from morphine, radiocontrast, aspirin and muscle relaxants.

The complement system contains three proteins (C3a, C4a, and C5a) that are called anaphylatoxins because of their role in triggering pseudoanaphylaxis. The most common trigger for this mechanism is an intravenous infusion of an iodine-containing radiological contrast medium.

The mechanism by which other substances, commonly called *histamine liberators*, trigger mast cell de-granulation, is poorly understood. Some substances are known to be effective liberators in susceptible people, including egg white, strawberries, and a variety of medications.

Sudden onset and rapid progression of symptoms

- The patient will feel and look unwell.
- Most reactions occur over several minutes. Rarely, reactions may be slower on onset.
- The time of onset of an anaphylactic reaction depends on the type of trigger.
- An intravenous trigger will cause a more rapid onset of reaction than stings
- which, in turn, tend to cause a more rapid onset than orally ingested triggers
- The patient is usually anxious and can experience a “sense of impending doom”.[28]

Life-threatening Airway and/or Breathing and/or Circulation Problems

Patients can have either an A or B or C problem or any combination. Use the ABCDE approach to recognise these.

Airway problems:

- Airway swelling, e.g., throat and tongue swelling (pharyngeal/laryngeal oedema). The patient has difficulty in breathing and swallowing and feels that the throat is closing up.
- Hoarse voice.
- Stridor – this is a high-pitched inspiratory noise caused by upper airway obstruction.

Breathing problems:

- Shortness of breath – increased respiratory rate.
- Wheeze.
- Patient becoming tired.
- Confusion caused by hypoxia.
- Cyanosis (appears blue) – this is usually a late sign.
- Respiratory arrest.

There is a range of presentation from anaphylaxis, through anaphylaxis with predominantly asthmatic features, to a pure acute asthma attack with no other features of anaphylaxis. Life-threatening asthma with no features of anaphylaxis can be triggered by food allergy.[29] Anaphylaxis can present as a primary respiratory arrest.[15 25]

Circulation problems:

- Signs of shock – pale, clammy.
- Increased pulse rate (tachycardia).
- Low blood pressure (hypotension) – feeling faint (dizziness), collapse.
- Decreased conscious level or loss of consciousness.
- Anaphylaxis can cause myocardial ischaemia and electrocardiograph (ECG) changes even in individuals with normal coronary arteries.[30]
- Cardiac arrest.

Circulation problems (often referred to as anaphylactic shock) can be caused by direct myocardial depression, vasodilation and capillary leak, and loss of fluid from the circulation.
Bradycardia (a slow pulse) is usually a late feature, often preceding cardiac arrest.[31]

The circulatory effects do not respond, or respond only transiently, to simple measures such as lying the patient down and raising the legs.

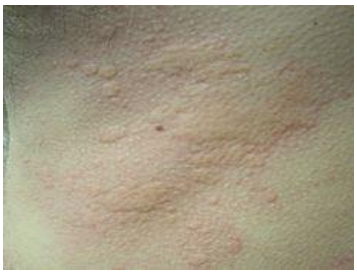
Patients with anaphylaxis can deteriorate if made to sit up or stand up.[32]

The above Airway, Breathing and Circulation problems can all alter the patient's neurological status (**Disability problems**) because of decreased brain perfusion. There may be confusion, agitation and loss of consciousness.
Patients can also have gastro-intestinal symptoms (abdominal pain, incontinence, vomiting).

Skin and/or mucosal changes

These should be assessed as part of the **Exposure** when using the ABCDE approach.

- They are often the first feature and present in over 80% of anaphylactic reactions.[33]
- They can be subtle or dramatic.
- There may be just skin, just mucosal, or both skin and mucosal changes.
- There may be erythema – a patchy, or generalised, red rash.
- There may be urticaria (also called hives, nettle rash, weals or welts), which can appear anywhere on the body. The weals may be pale, pink or red, and may look like nettle stings. They can be different shapes and sizes, and are often surrounded by a red flare. They are usually itchy.



Angioedema is similar to urticaria but involves swelling of deeper tissues, most commonly in the eyelids and lips, and sometimes in the mouth and throat.

Although skin changes can be worrying or distressing for patients and those treating

them, skin changes without life-threatening airway, breathing or circulation problems do not signify an anaphylactic reaction.

Reassuringly, most patients who have skin changes caused by allergy do not go on to develop an anaphylactic reaction.

Differential diagnosis

Life-threatening conditions:

- Sometimes an anaphylactic reaction can present with symptoms and signs that are very similar to life-threatening asthma – this is commonest in children.
- A low blood pressure (or normal in children) with a petechial or purpuric rash can be a sign of septic shock.
- Seek help early if there are any doubts about the diagnosis and treatment.
- Following an ABCDE approach will help with treating the differential diagnoses.

Non life-threatening conditions (these usually respond to simple measures):

- Faint (vasovagal episode).
- Panic attack.
- Breath-holding episode in child.
- Idiopathic (non-allergic) urticaria or angioedema.

There can be confusion between an anaphylactic reaction and a panic attack. Victims of previous anaphylaxis may be particularly prone to panic attacks if they think they have been re-exposed to the allergen that caused a previous problem. The sense of impending doom and breathlessness leading to hyperventilation are symptoms that resemble anaphylaxis in some ways. While there is no hypotension, pallor, wheeze, or urticarial rash or swelling, there may sometimes be flushing or blotchy skin associated with anxiety adding to the diagnostic difficulty.

Diagnostic difficulty may also occur with vasovagal attacks after immunisation procedures, but the absence of rash, breathing difficulties, and swelling are useful distinguishing features, as is the slow pulse of a vasovagal attack compared with the rapid pulse of a severe anaphylactic episode. Fainting will usually respond to lying the patient down and raising the legs.

As the diagnosis of anaphylaxis is not always obvious, all those who treat anaphylaxis must have a systematic approach to the sick patient. In general, the clinical signs of critical illness are similar whatever the underlying process because they reflect failing respiratory, cardiovascular, and neurological systems, i.e., ABCDE problems.

Use an ABCDE approach to recognise and treat an anaphylactic reaction. Treat life-threatening problems as you find them. The basic principles of treatment are the same for all age groups.

The specific treatment of an anaphylactic reaction depends on:

1. Location.

2. Training and skills of rescuers.
3. Number of responders.
4. Equipment and drugs available.

- **Location**
  Treating a patient with anaphylaxis in the community will not be the same as in an acute hospital. Out of hospital, an ambulance must be called early and the patient transported to an emergency department.

- **Training of rescuers**
  All clinical staff should be able to call for help and initiate treatment in a patient with an anaphylactic reaction. Rescuers must use the skills for which they are trained. Clinical staff who give parenteral medications should have initial training and regular updates in dealing with anaphylactic reactions. The Health Protection Agency recommends that staff who give immunisations should have annual updates.[34]

- **Number of responders**
  The single responder must always ensure that help is coming. If there are several rescuers, several actions can be undertaken simultaneously.

- **Equipment and drugs available**
  Resuscitation equipment and drugs to help with the rapid resuscitation of a patient with an anaphylactic reaction must be immediately available in all clinical settings. Clinical staff should be familiar with the equipment and drugs they have available and should check them regularly.

  All patients who have had an anaphylactic reaction should be monitored (e.g., by ambulance crew, in the emergency department etc,) as soon as possible.

  Minimal monitoring includes pulse oximetry, non-invasive blood pressure and 3-lead ECG.

  Monitoring must be supervised by an individual who is skilled at interpreting and responding to any changes.

Patients having an anaphylactic reaction in any setting should expect the following as a minimum:

1. Recognition that they are seriously unwell.
2. An early call for help.
3. Initial assessment and treatments based on an ABCDE approach.
4. Adrenaline therapy if indicated.
5. Investigation and follow-up by an allergy specialist.

Patient positioning

All patients should be placed in a comfortable position. The following factors should be considered:

- Patients with Airway and Breathing problems may prefer to sit up as this will make breathing easier.
- Lying flat with or without leg elevation is helpful for patients with a low blood pressure (Circulation problem). If the patient feels faint, do not sit or stand them up - this can cause cardiac arrest.[32]
- Patients who are breathing and unconscious should be placed on their side recovery position).
- Pregnant patients should lie on their left side to prevent caval compression.[35]

Remove the trigger if possible

Removing the trigger for an anaphylactic reaction is not always possible.

- Stop any drug suspected of causing an anaphylactic reaction (e.g., stop intravenous infusion of a gelatin solution or antibiotic).
- Remove the stinger after a bee sting. Early removal is more important than the method of removal.[36]
- After food-induced anaphylaxis, attempts to make the patient vomit are not recommended.
- Do not delay definitive treatment if removing the trigger is not feasible.

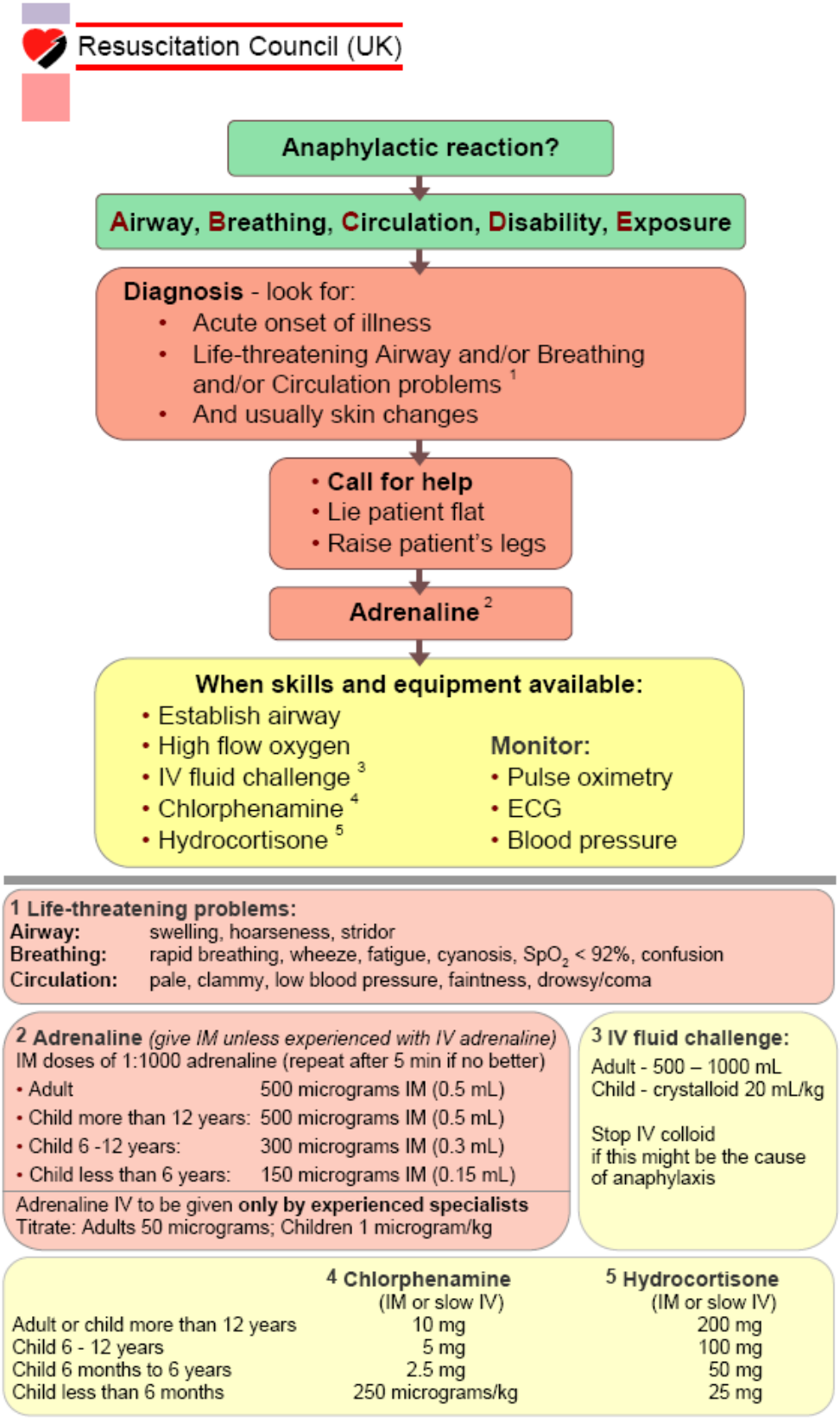
Cardiorespiratory arrest following an anaphylactic reaction

Start cardiopulmonary resuscitation (CPR) immediately and follow current guidelines.[35 37 38]

Rescuers should ensure that help is on its way as early advanced life support (ALS) is essential.

Use doses of adrenaline recommended in the ALS guidelines. The intramuscular route for adrenaline is not recommended after cardiac arrest has occurred.

4.6 Anaphylaxis algorithm



Adrenaline (Epinephrine)

Adrenaline is the most important drug for the treatment of an anaphylactic reaction.[39] Although there are no randomised controlled trials, adrenaline is a logical treatment[31] and there is consistent anecdotal evidence supporting its use to ease breathing difficulty and restore adequate cardiac output. As an alpha-receptor agonist, it reverses peripheral vasodilation and reduces oedema. Its beta-receptor activity dilates the bronchial airways, increases the force of myocardial contraction, and suppresses histamine and leukotriene release. There are also beta-2 adrenergic receptors on mast cells[40] that inhibit activation[41], and so early adrenaline attenuates the severity of IgE-mediated allergic reactions. Adrenaline seems to work best when given early after the onset of the reaction[42] but it is not without risk, particularly when given intravenously.[25] Adverse effects are extremely rare with correct doses injected intramuscularly (IM). Sometimes there has been uncertainty about whether complications (e.g., myocardial ischaemia) have been caused by the allergen itself or by the adrenaline given to treat it.

Difficulties can arise if the clinical picture is evolving when the patient is first assessed. Adrenaline should be given to all patients with life-threatening features. If these features are absent but there are other features of a systemic allergic reaction, the patient needs careful observation and symptomatic treatment using the ABCDE approach.

Adrenaline must be readily available in clinical areas where an anaphylactic reaction could occur.

Intramuscular (IM) Adrenaline

The intramuscular (IM) route is the best for most individuals who have to give adrenaline to treat an anaphylactic reaction. Monitor the patient as soon as possible (pulse, blood pressure, ECG, pulse oximetry). This will help monitor the response to adrenaline. The IM route has several benefits:

- There is a greater margin of safety.
- It does not require intravenous access.
- The IM route is easier to learn.
- The best site for IM injection is the anterolateral aspect of the middle third of the
- thigh.[43] The needle used for injection needs to be sufficiently long to ensure that the adrenaline is injected into muscle

The subcutaneous or inhaled routes for adrenaline are not recommended for the treatment of an anaphylactic reaction because they are less effective.[43 45 46]

Adrenaline IM dose – adults

0.5 mg IM (= 500 micrograms = 0.5 mL of 1:1000) adrenaline

Adrenaline IM dose – children

The scientific basis for the recommended doses is weak. The recommended doses are based on what is considered to be safe and practical to draw up and inject in an emergency.[47]

(The equivalent volume of 1:1000 adrenaline is shown in brackets)

> 12 years:	500 micrograms IM (0.5 mL) i.e. same as adult dose
	300 micrograms (0.3 mL) if child is small or prepubertal
> 6 – 12 years:	300 micrograms IM (0.3 mL)
> 6 months – 6 years:	150 micrograms IM (0.15 mL)
< 6 months:	150 micrograms IM (0.15 mL)

Repeat the IM adrenaline dose if there is no improvement in the patient's condition. Further doses can be given at about 5-minute intervals according to the patient's response.

Intravenous (IV) adrenaline (for specialist use only)

The intramuscular (IM) route for adrenaline is the route of choice for most healthcare providers (see section 5.2)

There is a much greater risk of causing harmful side effects by inappropriate dosage or misdiagnosis of anaphylaxis when using IV adrenaline.[4] This is why the IM route is recommended for most healthcare providers.

This section on IV adrenaline only applies to those experienced in the use and titration of vasopressors in their normal clinical practice (e.g., anaesthetists, emergency physicians, intensive care doctors).

Many healthcare providers will have given IV adrenaline as part of resuscitating a patient in cardiac arrest. This alone is insufficient experience to use IV adrenaline for the treatment of an anaphylactic reaction. In patients with a spontaneous circulation, intravenous adrenaline can cause life-threatening hypertension, tachycardia, arrhythmias, and myocardial ischaemia.

If IV access is not available or not achieved rapidly, use the IM route for adrenaline. Patients who are given IV adrenaline must be monitored – continuous ECG and pulse oximetry and frequent non-invasive blood pressure measurements as a minimum.

Patients who require repeated IM doses of adrenaline may benefit from IV adrenaline. It is essential that these patients receive expert help early. If the patient requires repeated IV bolus doses of adrenaline, start an adrenaline infusion.

FOR SPECIALIST USE ONLY

Ensure patient is monitored

Adrenaline IV bolus dose – adult:

Titrate IV adrenaline using 50 microgram boluses according to response.
If repeated adrenaline doses are needed, start an IV adrenaline infusion.

The pre-filled 10 mL syringe of 1:10,000 adrenaline contains 100 micrograms/mL. A dose of 50 micrograms is 0.5 mL, which is the smallest dose that can be given accurately.

Do not give the undiluted 1:1000 adrenaline concentration IV.

Adrenaline IV bolus dose – children:

IM adrenaline is the preferred route for children having an anaphylactic reaction. The IV route is recommended only in specialist paediatric settings by those familiar with its use (e.g., paediatric anaesthetists, paediatric emergency physicians, paediatric intensivists) and if the patient is monitored and IV access is already available. There is no evidence on which to base a dose recommendation - the dose is titrated according to response. A child may respond to a dose as small as 1 microgram/kg. This requires very careful dilution and checking to prevent dose errors.

Adrenaline infusion

An infusion of adrenaline with the rate titrated according to response in the presence of continued haemodynamic monitoring is an effective way of giving adrenaline during anaphylaxis.[48] Use local guidelines for the preparation and infusion of adrenaline.

FOR SPECIALIST USE ONLY

Adrenaline in special populations

Previous guidelines recommended adrenaline dose adjustments in certain circumstances (e.g., in patients taking tricyclic antidepressants, the previous recommendation was to give half the dose). The Working Group considered it unhelpful to have caveats such as this in the setting of an acute anaphylactic reaction. There is large inter-individual variability in the response to adrenaline. In clinical practice, it is important to monitor the response; start with a safe dose and give further doses if a greater response is needed, i.e., titrate the dose according to effect.
Adrenaline can fail to reverse the clinical manifestation of an anaphylactic reaction, especially when its use is delayed or in patients treated with beta-blockers.[49] The decision to prescribe a beta-blocker to a patient at increased risk of an anaphylactic

reaction should be made only after assessment by an allergist and cardiologist. [50] [51]

Adrenaline auto-injectors

Auto-injectors are often given to patients at risk of anaphylaxis for their own use. At the time of writing, there are only two doses of adrenaline auto-injector commonly available: 0.15 and 0.3 mg. The more appropriate dose for an auto-injector should be prescribed for individual patients by allergy specialists. Healthcare professionals should be familiar with the use of the most commonly available auto-injector devices. The dose recommendations for adrenaline in this guideline are intended for healthcare providers treating an anaphylactic reaction.
If an adrenaline auto-injector is the only available adrenaline preparation when treating anaphylaxis, healthcare providers should use it.

Oxygen (give as soon as available)

Initially, give the highest concentration of oxygen possible using a mask with an oxygen reservoir. Ensure high flow oxygen (usually greater than 10 litres min^{-1}) to prevent collapse of the reservoir during inspiration. If the patient's trachea is intubated, ventilate the lungs with high concentration oxygen using a self-inflating bag.

Intravenous Fluids (give as soon as available)

Large volumes of fluid may leak from the patient's circulation during an anaphylactic reaction. There will also be vasodilation, a low blood pressure and signs of shock. If there is intravenous access, infuse intravenous fluids immediately. Give a rapid IV fluid challenge (20 mL/kg in a child or 500-1000 mL in an adult) and monitor the response; give further doses as necessary. There is no evidence to support the use of colloids over crystalloids in this setting. Consider colloid infusion as a cause in a patient receiving a colloid at the time of onset of an anaphylactic reaction and stop the infusion.[52] [53] Hartmann's solution or 0.9% saline are suitable fluids for initial resuscitation. A large volume of fluid may be needed.

If intravenous access is delayed or impossible, the intra-osseous route can be used for fluids or drugs when resuscitating children or adults, but only by healthcare workers who are accustomed to do so.[54] Do not delay the administration of IM adrenaline attempting intra-osseous access.

Antihistamines (after initial resuscitation)

Antihistamines are a second line treatment for an anaphylactic reaction. The evidence to support their use is weak, but there are logical reasons for them.[55] Antihistamines (H_1-antihistamine) may help counter histamine-mediated vasodilation and bronchoconstriction. They may not help in reactions depending in part on other

mediators but they have the virtue of safety. Used alone, they are unlikely to be lifesaving in a true anaphylactic reaction. Inject chlorphenamine slowly intravenously or intramuscularly.

The dose of chlorphenamine depends on age:

>12 years and adults:	10 mg IM or IV slowly
>6 – 12 years:	5 mg IM or IV slowly
>6 months – 6 years:	2.5 mg IM or IV slowly
<6 months:	250 micrograms/kg IM or IV slowly

There is little evidence to support the routine use of an H_2-antihistamine (e.g., ranitidine, cimetidine) for the initial treatment of an anaphylactic reaction.[56]

Steroids (give after initial resuscitation)

Corticosteroids may help prevent or shorten protracted reactions. In asthma, early corticosteroid treatment is beneficial in adults and children.[57 58] There is little evidence on which to base the optimum dose of hydrocortisone in anaphylaxis. In hospital patients with asthma, higher doses of hydrocortisone do not seem to be better than smaller doses.[59]

Inject hydrocortisone slowly intravenously or intramuscularly, taking care to avoid inducing further hypotension.

The dose of hydrocortisone for adults and children depends on age:

>12 years and adults:	200 mg IM or IV slowly
>6 – 12 years:	100 mg IM or IV slowly
>6 months – 6 years:	50 mg IM or IV slowly
<6 months:	25 mg IM or IV slowly

Other drugs

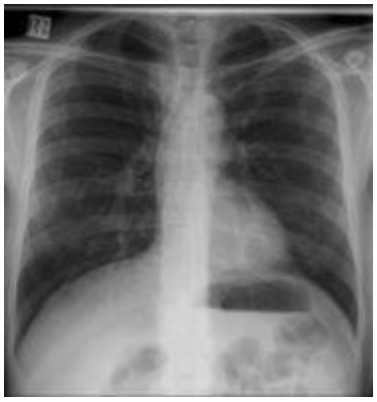
Bronchodilators

The presenting symptoms and signs of a severe anaphylactic reaction and lifethreatening asthma can be the same. If the patient has asthma-like features alone, follow the British Thoracic Society – SIGN asthma guidelines (www.brit-thoracic.org.uk). As well as the drugs listed above, consider further bronchodilator therapy with salbutamol (inhaled or IV), ipratropium (inhaled), aminophylline (IV) or magnesium (IV). Remember that intravenous magnesium is a vasodilator and can cause hot flushes and make hypotension worse.

Cardiac drugs

Adrenaline remains the first line vasopressor for the treatment of anaphylactic reactions. There are animal studies and case reports describing the use of other vasopressors and inotropes (noradrenaline, vasopressin, metaraminol and glucagon) when initial resuscitation with adrenaline and fluids has not been successful.[60-64] Only use these drugs in specialist settings (e.g., intensive care units) where there is experience in their use. Glucagon can be useful to treat an anaphylactic reaction in a patient taking a beta-blocker.[65] Some patients develop severe bradycardia after an anaphylactic reaction. Consider IV atropine to treat this.[37 48]

Undertake the usual investigations appropriate for a medical emergency, e.g., 12-lead ECG, chest X-ray, urea and electrolytes, arterial blood gases etc.



Investigations

Mast cell tryptase

The specific test to help confirm a diagnosis of an anaphylactic reaction is measurement of mast cell tryptase. Tryptase is the major protein component of mast cell secretory granules.

In anaphylaxis, mast cell degranulation leads to markedly increased blood tryptase concentrations (Figure 4). Tryptase levels are useful in the follow-up of suspected anaphylactic reactions, not in the initial recognition and treatment: measuring tryptase levels must not delay initial resuscitation. Tryptase concentrations in the blood may not increase significantly until 30 minutes or more after the onset of symptoms, and peak 1-2 hours after onset.[66] The half-life of tryptase is short (approximately 2 hours), and concentrations may be back to normal within 6-8 hours, so timing of any blood samples is very important.

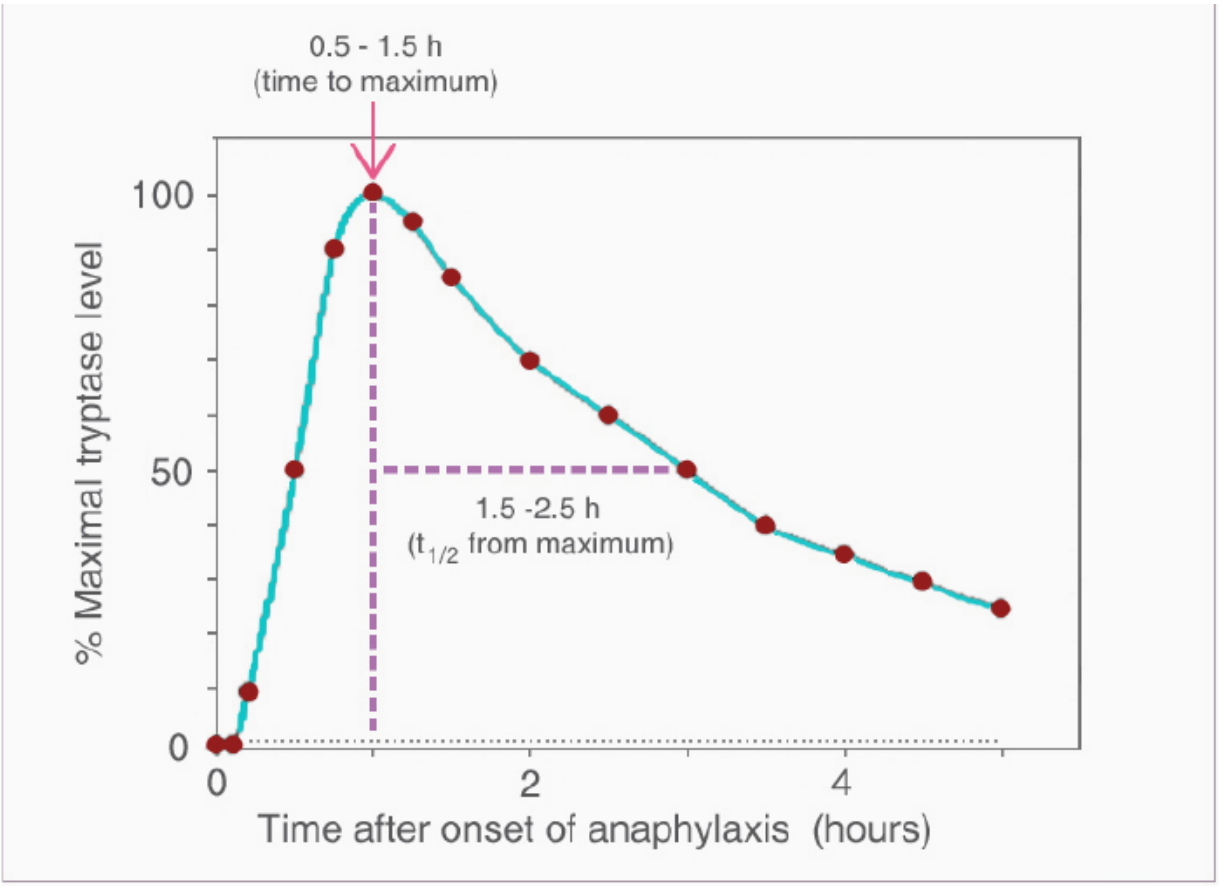


Figure 4. Suggested time course for the appearance of tryptase in serum or plasma during systemic anaphylaxis.[66] Reproduced and adapted with permission from Elsevier.

Sample timing

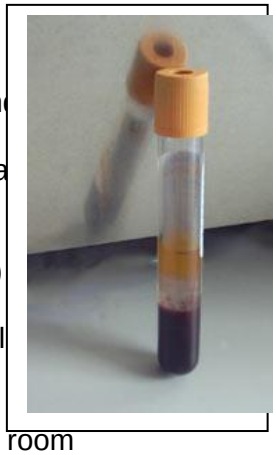
The time of onset of the anaphylactic reaction is the time when symptoms were first noticed. It is important that this time is accurately recorded.
a) Minimum: one sample at 1-2 hours after the start of symptoms.
b) Ideally: Three ***timed*** samples:
1) Initial sample as soon as feasible after resuscitation has started – do not delay resuscitation to take sample.
2) Second sample at 1-2 hours after the start of symptoms
3) Third sample either at 24 hours or in convalescence (for example in a follow up allergy clinic).

This provides baseline tryptase levels - some individuals have an elevated baseline level.

Serial samples have better specificity and sensitivity than a single measurement in the confirmation of anaphylaxis.[67]

Sample requirements

1) Use a serum or clotted blood ('liver function test' yellow topped bottle) sample. Some laboratories ask for a plasma sample – either plasma or serum samples can be tested.



2) ***Record the timing of each sample accurately*** on the sample bottle and request form. State on the request form the time of onset of the reaction (symptoms). Record on the sample bottle the number of minutes or hours after onset of symptoms the sample was taken

3) As little as 0.5 mL of sample can be enough (children), but 5 mL (adults)

4) Optimally, store the serum from spun samples frozen (-20$_0$C) in the local before dispatch to a reference laboratory.

5) Tryptase is very stable (50% of tryptase is still detectable after 4 days at room temperature[66]), so even samples stored at room temperature over a weekend can give useful, though sub-optimal, information.

6) Consult your local laboratory if you have any queries.

Discharge from hospital

Patients who have had a suspected anaphylactic reaction (i.e. an airway, breathing or circulation (ABC) problem) should be treated and then observed for at least 6 hours in a clinical area with facilities for treating life-threatening ABC problems.[68]

They should then be reviewed by a senior clinician and a decision made about the need for further treatment or a longer period of observation.

Patients with a good response to initial treatment should be warned of the possibility of an early recurrence of symptoms and in some circumstances should be kept under observation for up to 24 hours.[69] This caution is particularly applicable to:

- Severe reactions with slow onset caused by idiopathic anaphylaxis.
- Reactions in individuals with severe asthma or with a severe asthmatic component.
- Reactions with the possibility of continuing absorption of allergen.
- Patients with a previous history of biphasic reactions (is the recurrence of symptoms within 72 hours with no further exposure to the allergen)
- Patients presenting in the evening or at night, or those who may not be able to respond to any deterioration.
- Patients in areas where access to emergency care is difficult.

The exact incidence of biphasic reactions is unknown. Although studies quote an incidence of 1-20%, it is not clear whether all the patients actually had an anaphylactic reaction and whether the initial treatment was appropriate.[70]

There is no reliable way of predicting who will have a biphasic reaction. It is therefore important that decisions about discharge are made for each patient by an experienced clinician.

Before discharge from hospital all patients must be:

- Reviewed by a senior clinician.
- Given clear instructions to return to hospital if symptoms return.
- Considered for anti-histamines and oral steroid therapy for up to 3 days. This is helpful for treatment of urticaria[71] and may decrease the chance of further

reaction.[68] [72]

- Considered for an adrenaline auto-injector (see below), or given a replacement.
- Have a plan for follow-up, including contact with the patient's general practitioner.

Record keeping

To help confirm the diagnosis of anaphylaxis and identify the most likely trigger, it is useful for the allergy clinic to have:

- A description of the reaction with circumstances and timings to help identify potential triggers.
- A list of administered treatments.
- Copies of relevant patient records, e.g., ambulance charts, emergency department records, observation charts, anaesthetic charts.
- Results of any investigations already completed, including the timings of mast cell tryptase samples.

Reporting of reaction

Adverse drug reactions that include an anaphylactic reaction should be reported to the Medicines and Healthcare products Regulatory Agency (MHRA) using the yellow card scheme (www.mhra.gov.uk). The British National Formulary (BNF) includes copies of the Yellow Card at the back of each edition.

Discuss all cases of fatal anaphylactic reaction with the coroner.

When to prescribe an adrenaline auto-injector

Emergency departments should liaise with their nearest specialist allergy service to devise a local guideline for which patients should be given an adrenaline auto-injector on discharge.

An auto-injector is an appropriate treatment for patients at increased risk of an idiopathic anaphylactic reaction, or for anyone at continued high risk of reaction e.g., to triggers such as venom stings and food-induced reactions (unless easy to avoid).

An auto-injector is not usually necessary for patients who have suffered drug-induced anaphylaxis, unless it is difficult to avoid the drug.
Ideally, all patients should be assessed by an allergy specialist and have a treatment plan based on their individual risk.[73]

Individuals provided with an auto-injector on discharge from hospital must be given instructions and training and have appropriate follow-up including contact with the patient's general practitioner.

Specialist referral

All patients presenting with anaphylaxis should be referred to an allergy clinic to identify the cause, and thereby reduce the risk of future reactions and prepare the patient to manage future episodes themselves. There is a list of specialist clinics on the British Society for Allergy and Clinical Immunology (BSACI) website. A list of

clinics with a specific interest in anaphylactic reactions during anaesthesia is available at the BSACI and Association of Anaesthetists of Great Britain and Ireland websites (www.bsaci.org and www.aagbi.org).

Patient education

Refer patients at risk of an anaphylactic reaction to an appropriate allergy clinic. Patients need to know the allergen responsible and how to avoid it. If the allergen is a food, they need to know what products are likely to contain it, and all the names that can be used to describe it. Where possible they also need to know how to avoid situations that could expose them to the allergen.

Patients need to be able to recognise the early symptoms of anaphylaxis, so that they can summon help quickly and prepare to use their emergency medication.

Patients at risk are usually advised to carry their adrenaline auto-injector with them at all times. Patients and those close to them (i.e., close family, friends, and carers) should receive training in using the auto-injector and should practise regularly using a suitable training device, so that they will know what to do in an emergency.[74]

Patients must always seek urgent medical assistance when experiencing anaphylaxis and after using an adrenaline auto-injector. Information about managing severe allergies can be obtained from their allergy specialist, general practitioner, other healthcare professional or the Anaphylaxis Campaign. Although there are no randomised clinical trials,[75] there is evidence that individualised action plans for self-management should decrease the risk of recurrence. [7 76]

All those at high risk of an anaphylactic reaction should consider wearing some device, such as a bracelet (e.g., Medic Alert), that provides information about their history of anaphylactic reaction

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Pharmacy

Risk categories for drugs.

Intravenous drugs have all been assessed for risk and are grouped accordingly as follows:

RED	High risk product. These drugs have complex administration methods and extra vigilance is needed when preparing and administering these drugs. Risk reduction strategies are required to minimise these risks.

AMBER	Moderate risk product. Risk reduction strategies are recommended.
GREEN	Low risk product. Risk reduction strategies should be considered.

More……

Notes…..

Reflection

Time taken to complete this workbook: _____

Discuss the relevance of the workbook to your own area of practice.

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What have you learnt from this?

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What learning points will you take back and develop in your own area?

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Has this given you any new ideas for different and /or safer practice?

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Signed :_____ Date:_____

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