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DEPARTMENT OF HEALTH AND SOCIAL SECURITY

To: Regional Health Authorities)
Area Health Authorities) for action
Boards of Governors)

Community Health Councils - for information

March 1976

HEALTH SERVICES DEVELOPMENT

ADDITION OF DRUGS TO INTRAVENOUS INFUSION FLUIDS

Summary

This circular commends to Health Authorities the Report of a Working Party on the Addition of Drugs to Intravenous Infusion Fluids.

1. A Working Party on the Addition of Drugs to Intravenous Infusion Fluids was set up by the Department in 1974 at the request of the Standing Medical, Nursing and Midwifery, and Pharmaceutical Advisory Committees, endorsed by the Central Health Services Council. The Working Party has now completed its Report, a copy of which is attached. The Report has been endorsed by the three Standing Advisory Committees concerned and by the Central Health Services Council. The recommendation in paragraphs 9.8 and 10.6 of the Report concerning nurse training has been accepted by the General Nursing Council and paragraph 7.10 has been brought to the attention of the bodies concerned with medical education.

2. The Report is commended to Health Authorities who are asked to bring its recommendations to the notice of staff concerned as appropriate.

3. In particular Area Health Authorities are asked to take early steps to ensure that a review of current local practice in the addition and administration of drugs via intravenous infusion fluids is instituted in each District by the District Management Team (or in single-District Areas the Area Management Team) and that a multi-disciplinary group is set up to carry out such a review and draw up a local policy for the approval of the Area Health Authority (as recommended in paragraphs 6.1-6.3 of the Report). In Districts where a Drug and Therapeutics Committee exists this task might be assigned to such a committee, augmented as necessary if it does not already contain sufficient members who are actively involved in the procedures in question. In multi-district areas the Area Health Authority will no doubt bear in mind the desirability of keeping to a minimum differences in local policies between the Districts. Particular attention is also drawn to the recommendations relating to training, and Authorities are asked to consider how these can best be implemented for staff already qualified professionally.

4. It is recommended that the local policy referred to in the preceding paragraph should be in the form of a document of which a copy can be given to all members of staff concerned as well as being readily available at ward and departmental level. In preparing this document consideration should be given to the need to specify which drugs may be added, and to which categories of intravenous infusion fluids, by nurses who have received appropriate training.

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REPORT OF THE
WORKING PARTY ON THE ADDITION OF DRUGS TO INTRAVENOUS INFUSION FLUIDS

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Chapter 1 - Introduction

1.1 The addition of drugs to intravenous infusion fluids has become an increasingly widely used method of drug administration in recent years. Whilst it is recognised that the administration of drugs in this way may sometimes be appropriate, there is no doubt that in some cases the intravenous route has been used for convenience only.

1.2 Growing concern about the hazards associated with this route of administration prompted a request from the Standing Medical, Nursing and Pharmaceutical Advisory Committees, endorsed by the Central Health Services Council, that the problems involved should be considered by a multi-disciplinary Working Party whose members were actively engaged in clinical practice. The Report of the Rosenheim Committee on the Prevention of Microbial Contamination of Medicinal Products had pointed out the hazards which could arise from contamination of the infusion fluid by micro-organisms during the addition process, and from incompatibility between the added drug and the fluid. It had also drawn attention to the fact that hospital staff who were involved in adding drugs to intravenous infusion fluids had not always received adequate training for this purpose.

1.3 The Department accordingly set up a Working Party with the following terms of reference:-

i. To investigate as widely as possible the problems arising from the practice of adding drugs to intravenous infusion fluids.

ii. To consider the relative responsibilities of consultants in charge of patients, junior medical staff, the pharmacist and the nurse when this practice is used.

iii. To consider whether the training of the nurse needs to be modified to meet the demands imposed upon her by the practice.

iv. To prepare notes for the guidance of the three professions involved in the practice.

v. To consider the possible value of preparing charts showing well known chemical and therapeutic incompatibilities of drugs which might be added to intravenous infusion fluids.

1.4 The Working Party met for the first time on 29 March 1974 and held eight meetings in all, in addition to a number of meetings of sub-groups.

Chapter 2 - Definition of the Problems

Evidence presented to the Working Party showed that:-

2.1 Drugs are to an increasing extent being added to intravenous fluids on the wards, for administration by continuous infusion. In some hospitals such additions are being made to between 30% and 45% of the infusion solutions used (see bibliography at Appendix A). In addition intermittent administration of drugs by the intravenous route using the giving set for this purpose is a common practice.

2.2 Strict asepsis cannot be observed when drugs are added to intravenous infusion fluids on the ward and infection is but one hazard associated with this practice. Doctors prescribing drugs to be given in this way do not always appear to appreciate fully the technical problems that may arise. These include changes in stability or solubility resulting from interaction either between the drug and the infusion fluid or between two or more added drugs. Reduced efficacy or increased toxicity may occur as a result.

2.3 Adequate information for the guidance of doctors who prescribe drugs for administration in this way is not usually available on wards. Such information is often published only in pharmaceutical literature. There is a general lack of appreciation that the pharmacist can advise on these procedures.

2.4 The addition and administration of drugs via intravenous infusion fluids is frequently carried out by nurses. However, their authority and responsibilities in this respect are in general not clearly defined; and local policies and standards of training in techniques appear to vary widely.

2.5 Difficulties often arise which may prejudice the safety of treatment because documents used for prescribing are unsuitable, handwriting is bad, instructions are incomplete or abbreviations are used. In many hospitals the addition of drugs to intravenous infusion fluids is either not recorded or records are destroyed when patients are discharged.

Chapter 3 - Pharmaceutical Considerations

3.1 Apart from the well-known problem of microbial contamination there are several important pharmaceutical considerations connected with the addition of drugs to intravenous infusion fluids.

3.2 Some infusion fluids are degraded by added drugs. Drugs should not be added to blood, plasma or other blood products, parenteral amino acids or lipid preparations, or infusions of mannitol or of sodium bicarbonate. For other fluids compatibility of the drug with the fluid should be checked with the pharmacist where specific information is not available from the package insert.

3.3 The addition of a drug to an intravenous infusion fluid may result in physical or chemical changes deleterious to the drug and may also result in its exposure to unfavourable conditions of light, air and temperature. The outcome may be an altered therapeutic response, an inactivated drug, or harmful by-products. Incompatibility between drug and fluid is not necessarily visible. It is essential that before a drug is added its compatibility with the fluid should be checked.

3.4 Drugs are usually added to intravenous infusion fluids as solutions in an appropriate solvent. A drug solution may have a specific gravity significantly different from that of the infusion fluid to which it is added, and consequently may, if not adequately mixed, layer in the infusion solution with resultant hazard to the patient. Adequate mixing is therefore essential.

3.5 Multiple drug additions to intravenous infusion fluids will exacerbate these problems and it is only under exceptional circumstances that this practice can be condoned. There is very little authorative information available on the stability and biological activity of the components of such mixtures of drugs.

Chapter 4 - A Rational Approach to Intravenous Drug Administration

4.1 Evidence presented to the Working Party indicates that the following drugs are those most commonly added to intravenous fluids for administration by continuous infusion:-

Potassium Chloride
Heparin
Lignocaine
Antibiotics
Corticosteroids
Vitamins
Oxytocin

Many other drugs are given less frequently by the same method.

4.2 Drugs should only be added to intravenous infusion fluids where this is positively indicated and not because it is more convenient to give them in this way. Other methods of administration are preferable for some drugs that are at present commonly given by continuous intravenous infusion. Where intramuscular or oral administration is feasible, the intravenous route should be avoided. Where the intravenous route has to be used the precise method and rate of administration is sometimes critically important in determining the efficacy or safety of therapy.

4.3 Continuous intravenous infusion is indicated only where the drug must be well diluted and given very slowly (eg potassium chloride) or where the maintenance of a constant therapeutic effect is required (eg heparin, lignocaine, oxytocin). The necessity to add drugs to sterile intravenous infusion fluids on the ward should be reduced to a minimum. Drugs which must be so added should be introduced immediately prior to administration.

4.4 Potassium chloride can be added to intravenous infusion fluids during manufacture and sterilised by autoclaving. A limited range of intravenous infusion fluids containing 20 and 40 millimoles of potassium per litre is now available and clinicians should be encouraged to rationalise intravenous potassium prescribing in order that full use can be made of such infusions.

4.5 Heparin made up in a small volume can be continuously infused intravenously more satisfactorily from a disposable syringe using a motorised infusion pump; this ensures better control over dosage rate and avoids the administration of large volumes of infusion fluids.

4.6 Dextrose or fructose infusions containing lignocaine are manufactured in some hospital pharmacies with facilities for making intravenous infusion fluids; these infusions should be made available and used more widely.

4.7 Intermittent intravenous administration (see paragraph 4.10 below) is indicated only where there is no alternative means of achieving high blood levels of the drug.

4.8 Where the intravenous route is positively indicated most antibiotics (see Appendix B) are preferably given intermittently. When antibiotics must be given parenterally intramuscular administration is often preferable to the intravenous route. Continuous intravenous infusion is indicated only for antibiotics which are too toxic or irritant to give intermittently.

4.9 The proven indications for giving vitamin B compound with vitamin C injection by continuous intravenous infusion are very few, although it is commonly administered by this route.

4.10 Several techniques for giving intravenous drugs intermittently via an infusion fluid are available including:-

a. puncturing of the injection site of the infusion set,

b. the use of a set incorporating a burette,

c. injection into a fixed needle or cannula,

d. injection via a diaphragm in the side arm of a three-way tap, and

e. administration by means of a second infusion container and set, linked to the main infusion line by a Y piece.

The choice depends mainly on practical considerations. All the above methods are potentially hazardous unless careful consideration is given to the concentration of the drug solution, the vehicle in which it is dissolved and the rate of injection. Repeated puncturing of the injection site of the infusion set, particularly if it is not changed frequently, presents an infection hazard.

4.11 Before giving or prescribing any drug intravenously the prescriber should satisfy himself that the precise method of administration chosen can be relied upon in terms of both efficacy and safety. The prescribing of multiple drug additions to a single intravenous infusion fluid should be avoided wherever possible on account of the greatly increased risk of drug interaction.

4.12 Appendix B lists some drugs commonly given intravenously together with methods of administration. Information on methods of administration can usually be obtained from package literature or the hospital pharmacy.

Chapter 5 - Documentation

5.1 Where drugs are to be administered via an intravenous infusion fluid it is of paramount importance that prescribers provide clear, unambiguous, written instructions on documents designed specifically for the purpose.

5.2 Because local circumstances vary, the Working Party has not produced detailed models of documents, but has set out principles to be followed.

5.3 There should be a complete record of all intravenous infusion therapy prescribed for and given to each patient during his stay in hospital. This should include all drugs added to intravenous infusion fluids prior to the commencement of the infusion. It should be on a separate infusion sheet or a separate section of the main prescription sheet and should be retained as part of the patient's permanent medical record.

5.4 The fluid balance chart is commonly discarded on discharge of the patient and is not therefore usually suitable as the primary document for prescribing and recording intravenous infusion therapy and added drugs.

5.5 Drugs to be given by intermittent intravenous injection at specific times (see paragraph 4.10) should be prescribed on the main prescription sheet to ensure that they are given.

5.6 Decisions should be taken locally (see Chapter 6) concerning the following:-

a. precise definitions to be used for describing on prescription forms different methods of giving drugs intravenously (see Chapter 4);

b. which documents are to be used for prescribing intravenous drugs given by the various methods; and

c. the design of the document used for prescribing infusion therapy and added drugs; this should make provision for entering:-

i. the name and volume of the infusion fluid,

ii. the name and dose of any drug to be added prior to the commencement of infusion,

iii. the infusion rate,

iv. the time to be commenced,

v. the signature of the prescriber,

vi. the time of the addition, and

vii. the identity of the person making the addition.

5.7 Distinctive printed labels should be available for attachment to infusion containers to which drugs have been added, on which the following information should be entered:-

a. the name of the patient,

b. the name and dose of the drug added, and

c. the date and time of addition.

Chapter 6 - The Responsibilities of Health Authorities

6.1 The Area Health Authority, as the employing authority, is responsible for overall policy relating to the care and welfare of the patient. It therefore has a responsibility to ensure that staffing resources are adequate. It is also responsible for ensuring that all staff concerned know and understand the agreed policy so far as it affects them and that they have received appropriate training.

6.2 The Working Party considers that the formulation and implementation of detailed policies and procedures designed to safeguard patients in local circumstances must be a local responsibility. It therefore recommends that in each District the District Management Team, or in single-District Areas the Area Management Team, should institute a review of current local practice concerned with the addition and administration of drugs via intravenous infusion fluids and in particular the respective responsibilities of doctors, pharmacists and nurses. The appropriate Pharmaceutical Officer should be invited to any meeting of the Team at which this subject is discussed.

6.3 The task of carrying out this review, drawing up a local policy for the approval of the Area Health Authority and continuously monitoring its implementation should be assigned to a multi-disciplinary group. Representation on this group should include staff from all three professions who are actively involved in these procedures. Issues which this group will need to consider include the definition of the respective areas of responsibility of the three professions, their educational needs, and the most effective means of ensuring that the local policy is known and understood by all the staff concerned. All staff should be adequately trained before they are expected to undertake these responsibilities.

6.4 Where specialised units use an expanded pattern of medication and technique, the local policy will need to provide for training related to those techniques and procedures.

Chapter 7 - The Responsibilities of Doctors

7.1 It is the responsibility of all medical practitioners who prescribe drugs to be given by the intravenous route to ensure that the drug is appropriate both for this method of administration and for the vehicle in which it is to be given.

7.2 In general, doctors are frequently unaware of the special problems and hazards which accompany the administration of drugs by their addition to intravenous infusion fluids. The doctor must first question in each instance whether the intravenous route is appropriate at all. The convenience of adding drugs to intravenous infusion fluids has too frequently been allowed to over-ride therapeutic and pharmaceutical considerations.

7.3 Having decided that the drug is to be given by the intravenous route, and the vehicle in which it is to be administered, the doctor must next decide how the drug is to be added. He has the choice of prescribing an intermittent injection of the drug, a large volume of diluted drug to be given slowly or a small volume infusion to be given by motorised pump.

7.4 If, exceptionally, more than one drug is to be given by the same intravenous infusion fluid, the doctor must take special care to avoid incompatibility. See also paragraphs 3.5 and 4.11.

7.5 Consultants should ensure that junior medical staff to whom responsibility for this aspect of patient care is delegated possess adequate knowledge of its hazards. This in turn implies that the consultant himself is informed as to current good therapeutic practice.

7.6 The consultant should be available for advice on problems relating to intravenous therapy as with any other form of treatment.

7.7 In most instances the junior hospital doctor writes the prescription for the individual patient. He must therefore ensure that his instructions are written clearly and contain all necessary information:-

a. drug, using approved name (in capital letters),

b. dose, using metric/SI units,

c. precise method of administration,

d. rate,

e. date and time.

He should sign the prescription.

7.8 If in any doubt, he should consult with senior medical colleagues or the pharmacist as appropriate.

7.9 Medical staff should be aware of the extent to which local policy allows them to delegate responsibility for the addition or administration of drugs via intravenous infusion fluids.

7.10 Education of all members of the medical profession in the practice of adding drugs to intravenous infusion fluids is of vital importance. Ideally this should start during the teaching of therapeutics in medical school, and should be updated regularly.

7.11 See also bibliography at Appendix A.

Chapter 8 - The Responsibilities of Pharmacists

8.1 The addition of drugs to intravenous infusion fluids is an aseptic pharmaceutical procedure which should ideally be carried out in appropriate environmental conditions under the direct control of a pharmacist. However, because this procedure must sometimes be undertaken immediately prior to administration, it is often carried out on the wards by medical or nursing staff.

8.2 The pharmacist should therefore carefully examine the possibilities of providing a dispensing service for the necessary drug-infusion mixtures which would enable these to be aseptically prepared in the pharmacy. This is particularly important if the contents of more than one vial or ampoule are to be added to the infusion fluid. Also the use of manufactured drug-infusion mixtures obtained from the pharmacy containing potassium chloride or lignocaine should be encouraged.

8.3 Pharmacists should advise on pharmaceutical aspects of policies and procedures concerned with intravenous drug prescribing, preparation and administration and on the training of medical and nursing staff required to undertake these procedures.

8.4 It should be the responsibility of pharmacists to monitor prescriptions for intravenous infusion and drug therapy to ensure that doctors and nurses are alerted to specific problems concerning the safety, stability and compatibility of drugs with intravenous infusion fluids.

8.5 Pharmacists should provide advice and information to medical and nursing staff as required on all pharmaceutical aspects of the addition of drugs to intravenous infusion fluids.

8.6 Pharmacists should ensure that their own staff are educated and trained in their duties in connection with the addition of drugs to intravenous infusion fluids.

8.7 See also bibliography at Appendix A.

Chapter 9 - The Responsibilities of Nurses

9.1 The Working Party considers that it should now be accepted that the responsibilities of certain nurses may include the addition and administration of certain drugs via intravenous infusion fluids within the locally agreed policy referred to in paragraphs 6.2-6.4. It should, however, be borne in mind that if the patient has an unexpected reaction to the drug or if an error has been made the nurse has to consult the doctor.

9.2 The responsibilities of nurses as defined in this chapter are intended to apply only to staff holding a statutory qualification in nursing - that is registered or enrolled nurses - who have received appropriate training and assessment in these procedures. The Working Party considers that the recommendations are equally applicable to state certified midwives but should be related to the guidance already provided by the Central Midwives Board. It may be necessary for nurses in training to carry out these procedures as part of their training under the direct supervision of a qualified nurse, but nursing auxiliaries should never be required to do so.

9.3 In all intravenous infusion therapy the nurse's responsibility will continue to include:-

a. checking that the container and fluid show no obvious faults or contamination,

b. checking that the prescribed fluid is administered to the right patient,

c. observing whether the intravenous line remains patent,

d. inspecting the site of injection and reporting any abnormality,

e. controlling the flow at the prescribed rate,

f. observing and reporting on the condition of the patient, and

g. maintaining all necessary records.

9.4 When a drug is prescribed to be added to or administered via an intravenous infusion fluid the prescription should be clearly written and should contain all the information specified in paragraph 7.7. If the nurse has any doubt about the prescriber's instructions at any time in the 24 hours, she should seek immediate further advice from a more experienced clinical nurse or from the prescriber.

9.5 If a nurse has reasonable grounds to question the accuracy or completeness of a prescription she has a duty to do so.

9.6 The legal position of a nurse who performs these duties must be clearly understood by the employing authority, the doctor and the nurse. The employing authority is vicariously liable for any negligence which may be committed by a nurse in the course of her employment, and this applies to the addition and administration of drugs via intravenous infusion fluids as to any other duty. The employing authority would normally arrange for a nurse against whom any claim for negligence was being made to be defended by the authority's solicitors and would pay any damages awarded against her provided she had not acted outside the scope of the locally agreed policy.

9.7 When the Area Health Authority has agreed on the extent to which the responsibility for adding or administering drugs via intravenous infusion fluids may be delegated to the nurse, the Authority, is responsible for ensuring that all nurses required to undertake these procedures have received appropriate education and training. This should include a knowledge and understanding of the details of the locally agreed policy and instructions.

9.8 In view of the need to ensure that all nurses have received the training necessary to carry out the procedures related to the addition and administration of drugs via intravenous infusion fluids it is recommended that, subject to the approval of the General Nursing Council, preparation for these responsibilities should in future be included in basic nurse training.

9.9 There will, however, be a need to provide in-service training for qualified nurses. Such training will be needed by qualified nurses in post as well as those returning to nursing after prolonged absence. Those nurses whose previous experience and training related to a different local policy will need a modified training programme, and additional training will be required for staff working in specialised units (see paragraph 6.4).

9.10 The Working Party has considered whether it would be desirable to have a procedure for authorising individual nurses to exercise these responsibilities. The effectiveness of such arrangements has been questioned, but the procedure for identifying nurses who have received the appropriate training should be considered when the local policy is formulated.

9.11 See also bibliography at Appendix A.

Chapter 10 - Summary of Main Recommendations

10.1 Each District (or Area) Management Team should institute a review of current local practice concerned with the addition and administration of drugs via intravenous infusion fluids. This review should be carried out by a multi-disciplinary group which should draw up an agreed local policy and continuously monitor its implementation. The Area Health Authority should ensure that all staff are made aware of this agreed policy and that they have received appropriate training. (Chapter 6).

10.2 It is the doctor's responsibility to ensure that a drug to be given by the intravenous route is appropriate for this method of administration and for the vehicle in which it is to be given. Consultants should ensure that junior medical staff are aware of the hazards associated with this aspect of patient care. Medical staff should ensure when they write prescriptions for this form of therapy that their instructions are complete and clear; they should also be aware of the extent to which local policy allows them to delegate responsibilities concerned with the addition or administration of drugs via intravenous infusion fluids. (Chapter 7).

10.3 Wherever possible, drug-infusion mixtures should be provided from the pharmacy. Pharmacists should advise on pharmaceutical aspects of policies and procedures concerned with the addition and administration of drugs via intravenous infusion fluids, and should ensure that doctors and nurses are alerted to specific problems which may arise. Pharmacists should not only provide for the training of their own staff but should also advise on the training of doctors and nurses in this area of drug therapy. (Chapter 8).

10.4 Drugs should only be added to intravenous infusion fluids where the intravenous route is positively indicated. Where continuous infusion is indicated the drug must be well diluted and thoroughly mixed with the infusion fluid and given slowly. Maximum use should be made of available infusions containing potassium chloride. Where the intravenous route is positively indicated most antibiotics should be given intermittently. The prescribing of multiple drug additions to a single intravenous infusion fluid should be avoided wherever possible. Drugs should not be added to blood or plasma, parenteral amino acid or lipid preparations, or infusions of mannitol or of sodium bicarbonate. In other cases compatibility of drug and fluid should be checked with the pharmacist where specific information is not available from the package insert. (Chapters 3 and 4).

10.5 There should be a complete record of all intravenous infusion therapy and added drugs prescribed for and given to each patient. This record should either be on a separate infusion sheet or a separate section of the main prescription sheet. The design of the document used for prescribing infusion therapy and added drugs should be decided locally. Distinctive labels giving relevant information should be attached to infusion containers to which drugs have been added. (Chapter 5).

10.6 It should be accepted that the responsibilities of certain nurses within the locally agreed policy may include the addition and administration of certain drugs via intravenous infusion fluids. These procedures should only be carried out by registered or enrolled nurses or state certified midwives who have received appropriate training and assessment. Subject to the approval of the General Nursing Council, preparation for these responsibilities should in future be included in basic nurse training. In-service training should also be provided. (Chapter 9).

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METHODS OF INTRAVENOUS ADMINISTRATION

Drug	Intermittent	Continuous Infusion	Remarks
Potassium Chloride	X	✓	Use manufactured solutions containing potassium wherever possible.
Heparin	✓	✓*	If continuously infused, motorised infusion pump preferable.
Lignocaine	✓	✓	For continuous infusion use manufactured solutions containing lignocaine wherever possible.
Antibiotics			
Benzylpenicillin) Ampicillin) Cloxacillin) Flucloxacillin) Cephaloridine) Cephalothin)	✓*	✓	
Carbenicillin	✓*	X	Carbenicillin not effective by continuous infusion
Gentamicin	✓*	✓	Much less effective by continuous infusion.
Tetracyclines	X	✓	
Fusidic Acid	X	✓	
Lincomycin	X	✓	
Corticosteroids	✓	✓	Use only preparations intended for intravenous administration; intermittent administration generally preferable.
Oxytocin	X	✓	

✓ = Safe
X = Contraindicated
* = Preferred intravenous method

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