

Certificate of Competence in the Administration of Intravenous Radiopharmaceuticals

By Healthcare Professionals Working in
Nuclear Medicine

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(RTNG)

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Executive Summary

This document been produced by representatives from the BNMS Radiographers, Technologists & Nurses Group.

It was instigated by the Professional Standards and Education committee, who saw the need for a transferable record of practical experience for non-medical nuclear medicine healthcare professionals performing intravenous injections of radiopharmaceuticals and non-radioactive medications used currently in clinical nuclear medicine.

It is not designed to be a theoretical teaching package but as a means of demonstrating the healthcare professional's practical experience. This applies both during their training period and while maintaining their practical skills and auditing their clinical practice.

It is not a professional qualification nor does it replace the need for the healthcare professional's appropriate training and qualification in nuclear medicine.

It **MUST** be used in line with the healthcare professional's local departmental procedures and policies, observing the IRMER regulations. This includes ensuring correct patient identification, that the patient is not pregnant and/or breast-feeding and that the correct activity and radiopharmaceutical are administered.

The healthcare professional is still responsible for their own professional registration and membership of any professional group.

Statement of Need

The intravenous administration of radiopharmaceuticals by healthcare professionals is a standard requirement for those working in nuclear medicine.

This certification document is designed to demonstrate the competence of those undertaking this role and to ensure that a high standard of service is maintained in all departments. It will also be transferable for those taking up employment in another unit.

Assessments

This certificate is designed for those training to administer radiopharmaceuticals and also for those being re-assessed.

All healthcare professionals working in nuclear medicine should self-assess on a yearly basis.

No healthcare professional shall practice unsupervised until all elements of the theory/practical assessments have been completed satisfactorily.

A competent supervisor must carry out practical assessments. To ensure the competence of the supervisor the following criteria must be met:

1. They must have a qualification in nuclear medicine/clinical technology/advanced nursing practice or equivalent
2. They must have been competent in administering radiopharmaceuticals for at least two years
3. They work in the healthcare professional's department

The assessment process consists of three stages:

- a. Theoretical preparation

- b. Observation
- c. Supervised practice

The healthcare professional holds professional responsibility to ensure that they maintain their own level of competence. They must keep up to date with new policies and procedures and any new evidence based medicine within this field. They must also adhere to their department's local rules and patient identification procedure in line with IRMER.

IRMER 2017

The Practitioner will be the ARSAC certificate holder or holders. Once the healthcare professional has completed the assessment process the ARSAC certificate holder must sign to say that they are competent to administer radiopharmaceuticals to patients. The person administering the radiopharmaceutical will be the operator. The ARSAC certificate holder will normally justify the procedure. Other healthcare professionals may authorise the administration of a radiopharmaceutical, providing they are acting under protocols using justification criteria listed in the healthcare professional's department IRMER Protocol Manual. All protocols must have written agreement from the relevant ARSAC certificate holder and departmental manager.

It is of paramount importance that all healthcare professionals who undertake the role of radiopharmaceutical administrations must be up to date with their basic life support training and if taking on more advanced roles are also advanced life support trained.

Theoretical Preparation

Intended Learning Outcomes

Upon completion of the learning programmes the candidate will:

1. Have knowledge of the anatomy of the arm and hand and be able to select an appropriate site for venepuncture.
2. Be able to select and use the correct equipment for the procedure.
3. Show an understanding of local standards and procedures regarding aseptic non-touch technique (ANTT), sharps disposal and handling body fluids.
4. Have knowledge of the potential complications and risks of the procedure.
5. Ensure patient needs regarding dignity and comfort are addressed.
6. Demonstrate an acceptable level of competence in technique.

All staff should understand their legal and professional responsibilities regarding venepuncture.

Indications for Venepuncture

1. To assist diagnosis of the patient.
2. To provide holistic care to the patient.

3. To avoid harm to the patient due to the omission of the procedure.
4. To remove blood as a form of therapy (e.g. Polycythaemia)
5. To remove blood for transfusion.

Contraindications for Venepuncture

1. Where there are any discrepancies in the identification details.
2. Without the patients permission except in emergency situations.
3. When the practitioner is not confident to proceed.
4. In dangerous situations where the practitioner or patient is put at risk.
5. Where no suitable vein is found.
6. Above the site of an IV infusion.
7. In areas of local sepsis.
8. On a sleeping patient.
9. On children under 16 without recognised paediatric training.
10. In the foot, leg or lower forearm unless absolutely necessary e.g. paediatrics.
11. In cases of confused patients without assistance.
12. On a paralysed limb.
13. On a bruised area, possible from a previous venepuncture.
14. Where there is evidence of lymphoedema or where surgery on axillary lymph nodes has taken place (e.g. Mastectomy patients).
15. From a renal fistula.
16. On a dying patient, unless essential.
17. As task orientation as opposed to holistic care.

Risks/Hazards Of Venepuncture

TO THE PRACTITIONER

Risk

How to avoid

Infection

Work cleanly, cover cuts, and observe universal precautions.

Sharps injury

Do not resheath needles, dispose of sharps immediately.

Assault by patient

Do not proceed in dangerous situations.

Accusation of assault

Accurate documentation. Do not proceed without consent.

TO THE PATIENT

Risk

How to avoid

Infection	Work cleanly. Apply dressing after procedure.
Bruising	Master good technique. Apologise if bruising occurs, apply pressure, document.
Bleeding	Apply pressure and elevate limb. Allow adequate time, apply dressing.
Haematoma	Master good technique to avoid this occurring. If this occurs apply pressure, give explanations, apologise and document. Continue to observe site.
Fear/anxiety	Reassurance before and during procedure.
Pain	Master good technique. Stop if pain persists.
Thrombophlebitis	Refer patient to doctor, advise use of ice packs and crepe bandage for comfort.
Sharps injury	Dispose of sharps immediately.
Assault	Always gain consent. Document consent ob
Fainting	Enquire if patient has had problems with venepuncture in the past, if so take extra precautions i.e. lie the patient down. If the patient feels faint stop the procedure. If the patient faints call for help. Do not allow the patient to leave until confident that they are fit
Accidental puncture of artery	Be aware of position of brachial artery. Avoid pulsating areas. If artery is punctured withdraw needle and apply firm digital pressure for 15 minutes or more. Elevate arm, document, and inform medical staff.

Patient Identification

Correct identification of patient and labelling of specimens is vital. An error in patient identification could result in the maladministration of a radiopharmaceutical and in the worse-case scenario a patient could receive another patient's blood products, which could cause life-threatening complications.

To avoid this:

1. Study the information on the request form.

2. Ask the patient to tell you their name and date of birth. Ensure this information corresponds with that on the request form.
3. All in-patients should be wearing wristbands, ensure that the details on the wristband match the details on the request form.

IF THE PATIENT IS NOT WEARING A WRISTBAND YOU MUST NOT PROCEED UNLESS YOU ARE SURE BEYOND DOUBT THAT THIS IS THE CORRECT PATIENT

Do not proceed if:

1. There is any discrepancy in the identification details.
2. There is a language barrier or other communication problem.
3. The patient is uncooperative.

Always refer to a senior member of staff if in any doubt.

Choosing A Suitable Vein

Choose veins which are:

- Preferably in the ante-cubital fossa (ACF)
- Easily palpable and bouncy to the touch
- Easily seen and/or felt
- Large enough to withstand procedure

Avoid veins which are:

- Fragile, small or delicate
- Sclerosed – hard, cordlike with no resilience
- Fibrosed – damaged by scar tissue
- Thrombosed – containing a clot
- Adjacent to areas of infection – inflamed and painful
- Superficial – easily seen on the surface but small and “thready”
- Tortuous – crooked
- In the foot, leg or inner side of lower forearm – where there may be a higher risk of thrombophlebitis
- Mobile – likely to roll if not adequately secured
- On limbs potentially affected at risk of lymphoedema – in patients that have undergone axillary lymph node dissections for breast cancer should use contralateral arm

Legal Guidelines

Under the NHS Constitution every person is legally owed a legal duty of care (NHS Constitution 2015). In addition the Nursing and Midwifery Council Code of Professional Conduct should be observed, particularly the following points:

4. Act in the best interests of people at all times

6. Always practise in line with the best available evidence
- 8 Work cooperatively
- 9 Share your skills, knowledge and experience for the benefit of people receiving care and your colleagues
- 13 Recognise and work within the limits of your competence
- 18 Advise on, prescribe, supply, dispense or administer medicines within the limits of your training and competence, the law, our guidance and other relevant policies, guidance and regulations

Do not proceed without consent

You are inflicting a wound. Patients can refuse treatment. A doctor has a duty to explain the consequences of the refusal but pressure must not be exerted on the patient to change their mind.

Consent can be verbal, written or implied. All are of equal value in law and it is not common practice to obtain written consent for venepuncture.

Unconscious and confused patients

In these situations the tests requested must be deemed necessary. The practitioner must act as the patients' advocate. If in doubt delegate the task back to the doctor. Do not proceed alone. Confused patients, though consenting can be unpredictable, unconscious patients can move.

Documentation

Keep accurate records. Document procedure in the patient notes. Record samples, dates, times etc. Also record bruising/haematoma. Inform patient. If consent is in question, document consent or refusal. Inform the doctor if patient refuses. For adults who lack the capacity to consent to investigation or treatment always ensure compliance the Mental Capacity Act (2005) according to local protocol.

Minors

For children up to the age of 16 years consent may be required from a parent or guardian. Only practitioners with a recognised paediatric qualification who have attended an approved paediatric venepuncture training programme may take blood from or inject children under the age of 16 unless a cannula is already in-situ.

Know who you are accountable to

1. Yourself
2. The patient
3. Your employer
4. Professional Body

Know your local policy

Be properly trained. Attend all relevant study sessions and supervised practice sessions. Be properly assessed by an approved assessor. Maintain your competency by regular practice.

Anatomy and Physiology of veins

All veins have three layers of tissue. The tunica external, the outer layer of fibrous tissue, is a relatively thick layer consisting mainly of elastic and collagen fibres. Nerves and lymphatic vessels are found within this connective tissue.

The middle layer, the tunica media, consists of elastic connective tissue and smooth muscle cells. This layer causes the veins to constrict or dilate in response to vaso-motor stimulation via sympathetic nerves.

The inner layer, the tunica intima, consists of smooth, simple squamous epithelial cells which are in contact with the blood. This layer is a continuation of the endocardial lining of the heart, and is present in all types of blood vessels.

Major veins contain valves which ensure that blood flows towards the heart. These valves are usually only apparent in long, straight veins in the arm. Having the tip of the needle terminate in a valve may obstruct the blood flow.

Factors affecting dilation or constriction of veins

Suggested procedure

Anxiety

Provide patient with adequate explanation and present a confident manner.

Temperature

Ensure that the patient is warm. Apply a warm compress if necessary to assist vasodilatation.

Clinical factors e.g. hypovolaemia

A maximum of three attempts to gain venous access should be made, after which experienced help should be sought.

Venous circulation is divided into two groups, deep and superficial. It is the superficial veins which are used for venepuncture. Knowledge of their position is essential in the selection of an appropriate venepuncture site. The main superficial veins are given below:

Upper limbs

Lower limbs

Cephalic vein

Short saphenous vein

Basilic vein

Long saphenous vein

Medial vein

Medial cubital vein

General Guidelines to selection of venipuncture site

Avoid veins close to arteries, nerves and deep vessels.

Avoid veins of lower limbs (although these are commonly used for paediatric patients).

If possible avoid veins which cross bony prominences with little subcutaneous cover as this causes increased discomfort.

Avoid limb if venous infusion is in progress.

Sites of choice

Basilic vein

Along ulnar side of fore and upper arm

Cephalic vein

Along radial side of fore and upper arm

Median cubital vein

Along ulnar side of forearm in ACF

These are large veins with wide lumens, able to provide copious and repeated specimens of blood.

Cautions

Palpation will aid in identifying the presence of arteries or nerves clinically by the presence of a pulse or by resistance.

Ensure that venepuncture is carried out on the correct patient by checking the wristband (for in-patients) or verbally (for outpatients) against the signed request card.

A maximum of three attempts to gain venous access should be made, after which help should be sought from a more experienced practitioner. Always gain consent from the patient to continue if initial attempts at venepuncture are unsuccessful.

Injection Techniques

There are several methods used to administer radiopharmaceuticals, which require different skills and considerations. All techniques used must be in line with the healthcare professional's own departmental protocols.

Finding a vein

Before approaching the patient, the healthcare professional should always ensure appropriate infection control measures - hand gel should be used to decontaminate their hands.

A tourniquet should be applied at a pressure that is greater than venous but lower than arterial pressure. This allows blood to flow into the arm but prevents it from leaving, causing the veins to fill with blood.

Disposable single-use tourniquets should be used – the use of fabric tourniquets is not recommended as these pose an infection control risk

Care should be taken not to pinch the patient's skin. Effective use of a tourniquet will allow palpation of veins, which will feel, hard and elastic.

The primary method of vein selection should be palpation although it is more straightforward if the vein can also be seen. The antecubital fossa (ACF) is the usual site. The network of dorsal veins of the hand may be used if ACF veins are not palpable but with caution as these are much smaller and are close to nerve tissues.

Fine veins and those that are thrombosed should be avoided and so should arteriovenous fistulas, as venepuncture can damage the vessels concerned.

The skin at the site of injection can be cleaned with an antiseptic cleanser (e.g. chlorhexidine/isopropyl alcohol wipes) safe for use on human skin. It should be given time to dry before the needle is inserted, otherwise it will cause stinging (30 seconds).

Right-handed practitioners should anchor the vein with their left thumb one or two inches down from the chosen site. This is especially important in older patients with mobile veins.

The needle should be inserted along the line of the vein. The tip of the needle should be inserted through the skin in one continuous movement. The angle of entry is about 15 degrees to the skin. (See notes on theoretical training).

Selection of the gauge of the needle or butterfly will be dependent upon the study being undertaken and the size of the patient's veins. Small gauge (24G and above) needles are advisable for all paediatric patients when a bolus administration is not required. When taking bloods the largest gauge is preferred, this is not always important and will depend upon local policies and procedures. The 'injector' must be familiar with these to ensure that they follow the correct protocol. The assessor will also be assessing the healthcare professional's ability to select the appropriate techniques in line with the above. Large gauge (21G and below) needles need not be used unless a rapid flow rate is required (e.g. the cannula will be used for contrast media in a contrast-enhanced CT component of hybrid imaging)

Direct Injection technique

Direct injections are not recommended for the administration of radiopharmaceuticals apart from in exceptional circumstances.

Using a Butterfly needle

This technique employs the same skills and principles as the direct injection technique. However a butterfly needle can be secured into the vein and a saline flush can be administered prior to the radiopharmaceutical administration. To ensure asepsis and minimise the risk of contamination a three-way tap is recommended in conjunction with the butterfly. The butterfly and the three-way tap must be flushed prior to the administration and care must be taken to flush the line and connection well after the administration so that the required activity to be administered is received by the patient.

Small gauge (25G orange) butterfly needles should be used for injections into dorsal venous network.

Advantages

The needle is more secure in the vein.

The patency of the vein can be checked prior to the administration of the radiopharmaceutical.

The radiopharmaceutical only needs to be handled once the vein has been cannulated, minimising the healthcare professional's finger radiation dose.

Disadvantages

The procedure involves using more equipment and takes longer.

There is more chance of some of the radiopharmaceutical being left in the line and hence the patient receiving a reduced activity.

Observation = 10 cases

Supervised practice = 20 cases

The Dynamic injection

This technique is best performed using a butterfly and a three-way tap as described above. It is required for certain procedures that need to have immediate post injection images or data. As it requires different communication skills and the use of other equipment it must be assessed separately. Each assessment will be done in line with the department's protocols and policies.

Observation = 10 cases

Supervised practice = 20 cases

Other Injection techniques

Each department may have other specific injection techniques that a healthcare professional may progress onto once they are proficient in the above. These specific techniques will require a different knowledge base and this must be assessed prior to the healthcare professional undertaking these administrations.

BNMS guidance on Administration of Medicinal Products by non-Medical Personnel (2013) includes a comprehensive list of drugs with potential adverse reactions used in clinical nuclear medicine.¹

The guidelines on training will be similar to the above:

Furosemide

The operator must be aware of the potential for causing a drop in the patient's blood pressure and the effect of delivering a fast bolus injection. (A slow administration is recommended).

The operator must be aware of the interaction of other medicines with Furosemide and seek advice if unsure of implications of the patients prescribed medication, such as ACE inhibitors.

Observation = 5 cases

Supervised practice = 5 cases

Breast sentinel node lymphoscintigraphy

The operator must be aware of the need to give a small volume (0.2-1ml) in the correct quadrant (lower/upper, outer/inner) of the correct side breast, using a small (25G) gauge needle. Departmental protocols should state whether the injection is intradermal or subareolar. It is important to ensure that the site is aseptic, the needle is not in a vein by drawing back and once administered the area is massaged to encourage lymphatic drainage. Further guidance is available from BNMS Procedure Guidelines for Radionuclide

Lymphoscintigraphy for Sentinel Node Localisation in Breast Carcinoma (2009).

Observation = 5 cases

Supervised practice = 5 cases

¹ For intravenous administration of I-123 or I-131 metaiodobenzylguanidine or mIBG, if there is concern over labile blood pressure this can be monitored before and after MIBG injection.

Lymphoscintigram (for lower or upper limb lymphoedema)

The operator must be aware of the need to give a very small volume (0.2-1ml) (into subcutaneous or intradermal tissue depending on local departmental protocol) using the smallest gauge needle possible (diabetic needles). It is important to ensure that the skin between the first two digits is aseptic before administration, the needle is not in a vein by drawing back and once administered the limb is mobile to encourage lymphatic drainage. Caution should be exercised to ensure no contamination is left on the patient's skin surface from the injection and that residual amounts of activity in syringes are measured for quantitation purposes. Further guidance is available from BNMS Procedure Guidelines for Lymphoscintigraphy (2011)

Observation = 3 cases

Supervised practice = 3 cases

Lung perfusion

The operator must be aware of the need to administer macroaggregated albumin (MAA) to patients while lying supine to avoid gravity effects. It is important to ensure the vial containing the labelled MAA is shaken and no saline is drawn back into the syringe before injecting to avoid "clumping". The patient should be asked to take several deep breaths during administration to ensure accurate distribution of MAA throughout capillary beds.

Observation = 3 cases

Supervised practice = 3 cases

Inserting a Cannula

Specific training in the use of cannulas would require working with a supervisor who has at least 2 years' experience in their use. Key points to note are the importance of not recapping the needle and not re-inserting the needle into the patient's vein. A new cannula is required for each attempt at cannulation. The use of "safety" IV cannulas (i.e. automatic sheathing of needle on retraction) is recommended.

Observation = 10 cases

Supervised practice = 20 cases

Transplant Renogram

The operator must be aware of avoiding the use of fistulas and employ a technique which delivers a good bolus injection. Also be aware of the need for anterior imaging.

Observation = 3 cases

Supervised practice = 3 cases

Paediatric Injections

Require specific training with a supervisor who is specialised in paediatric administrations. The number of observed and supervised cases would be equal to those expected for adult injections. Care should be taken with ensuring family members are cooperative as well as the paediatric patient. Many centres will have specialist paediatric outpatient departments who will cannulate children prior to them attending the imaging department. It is recommended to have two practitioners when administering radiopharmaceuticals for dynamic paediatric acquisitions.

Observation = 10 cases

Supervised practice = 20 cases

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Further Reading

Departments' Local Rules, Protocols and Policies

Local Infection Control Policies

Review

Date for review/update November 2023

Comment	Date	Version	Reviewer
Initial draft first posted	March 2006	V1	
2 nd draft	January 2010	V2	
Last revised	November 2018	V3	Sobhan Vinjamuri
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Lymphoscintigram Injection Log

Minimum: 3 Observed; 3 Supervised.

Trainee: _____ Supervisor: _____

Date	Hospital Number	Procedure	Radio-pharmacy	Route	Complications	Supervised	Observed	Supervisor Initials	Trainee Initials

Transplant Renogram Injection Log (If Applicable)

Minimum: 3 Observed; 3 Supervised.

Trainee: _____ Supervisor: _____

Date	Hospital Number	Procedure	Radio-pharmacy	Route	Complications	Supervised	Observed	Supervisor Initials	Trainee Initials

Review

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These guidelines do not constitute a formal protocol but highlight the aspects of a study where variation in practice may significantly affect the quality of outcome of the study.