### CHAPTER 10 - IMAGING

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INTERPRETATION OF X-RAYS RELATING TO THE DIAGNOSIS AND PREVENTION OF TUBERCULOSIS

Chest X-rays

Any hospital which does not have the services of a radiologist for the purpose of interpreting X-ray films, or has no other arrangement for the interpretation of films relating to the diagnosis and prevention of tuberculosis, should send these films to Sydney Hospital.

The following procedure should be observed in regard to films sent outside the hospital for interpretation:

- The information set out below should be written in black ink on the emulsion side of each film:
  - Day of X-ray
  - Name of hospital
  - Name of patient
  - Number of film
- Each postal package must be divided into two clearly marked groups, namely:
  - Chest X-rays for tuberculosis which are expected to be clear, e.g. routine chest X-ray of patients and staff. These are to be marked “Expected clear”;
  - Chest X-rays for tuberculosis where some abnormality is suspected. These are to be marked “Abnormality suspected”.
- Films for each group must be accompanied by clinical notes in duplicate which will include the name and age of the persons concerned; the notes must not be forwarded separately. One copy will be retained by the Institute and the original will be returned to the hospital with the reports thereon.

X-rays for Commonwealth and State Departments

Any hospital which does not have the services of a radiologist should forward X-rays taken on behalf of Commonwealth and State Departments in respect of Public Service entrants, Service personnel, X-rays relating to migrants and any other categories so referred to Sydney Hospital.

Categories of Chest X-rays which may be interpreted for tuberculosis purposes are as follows:

- Tuberculosis patients, pulmonary or non-pulmonary, for the purpose of investigation or treatment.
- Inactive tuberculosis patients.
- Contacts of tuberculosis.
- Tuberculin positive referrals, including those assessed for or on chemoprophylaxis.
- In or outpatients or other referrals where the referring doctor is of the opinion that the patient is most probably suffering from tuberculosis.
- Tuberculin positive silicosis.
- Patients suffering from sarcoidosis.
- Pre-employment X-rays of Commonwealth and State Public Servants, members of the State Bank and applicants for Commonwealth and Teachers College scholarships or bursaries.
- Employees of the Telecommunications and Postal Commissions of the Commonwealth working in Dusty Conditions (special request form).
- Certain miners applying to work in the Northern Territory (special request form).
- Employees of the Department of Agriculture (special request form).
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- Migrants, where referred by the Commonwealth Department of Health and the Commonwealth Department of Immigration and Ethnic Affairs or the Health Department of New South Wales.
- Referrals for tuberculosis purposes from other chest clinics intra- and inter-State, or from the Institute of Public Health Biosciences.
- Psychiatric patients.
- Gaol inmates.
- Nursing staff and ambulance staff dealing with tuberculosis patients (annually).
- Nursing staff, where tuberculin positive not due to BCG vaccination at beginning or end of training, or employment: This group should be referred to a Chest Clinic for assessment for X-ray and chemoprophylaxis and thus become recorded as legitimate registered Chest Clinic patients.
- People under an Order from the Health Department in terms of the Public Health Act 1902, for tuberculosis purposes.
- Large film follow-up following Compulsory Chest X-ray survey where hospital facilities are used. (Those definitely non-tuberculosis should be excluded.)
- Tuberculin positive Surf Life Savers.
- Staff working in bacteriological or X-ray departments where tuberculosis investigations are being carried out (annually).
- Inmates of Aged or Invalid Persons Homes.

Other X-Ray Films

Any hospital which does not have the services of a radiologist should consult with the Regional Director of Health regarding arrangements for the interpretation of X-rays other than those referred to above.

TRANSFER OF X-RAY FILMS AND REPORTS

To assist in reducing radiation hazards, X-ray films and reports should accompany a patient when he is sent from one public hospital to another. Hospitals should not require their return; they should remain with the hospital where the patient is receiving his treatment.

RADIOLOGICAL EXAMINATION OF THE RENAL TRACT, THE BILIARY TREE AND THE VASCULAR SYSTEM, USING IODINATED RADIO-OPAQUE CONTRAST MEDIA

Fatal reactions have been recorded with all of the above tests, which include intravenous pyelography, intravenous cholangiography, venography and arteriography.

Adverse reactions vary from minor allergic and constitutional effects to severe sensitivity, respiratory, cardio-vascular and cerebral crises. Death may result from any of the latter.

The reactions are of acute onset, but may be delayed.

Risk is lessened by withholding unnecessary tests, guarding against unnecessary repeat tests, preparing patients efficiently and reliably and being ready to treat reactions promptly and effectively if they arise.

Severely dehydrated and apprehensive patients are at special risk.

There is a risk of hypothermia in these tests, especially with infants.
Hospitals should always:
- ascertain any history of allergy or past drug reaction;
- have a doctor make the injection, leaving a needle in the vein until the test is complete, ensure that these patients are not left unobserved;
- have any but the most minor reactions reported to a doctor, who should be on the premises during the conduct of such examinations;
- have available in the examination room:

Oxygen, respirator apparatus, airways and intra-tracheal tubes, laryngoscope, connectors, apparatus to set up an intravenous infusion and drugs necessary to treat allergic, respiratory, cardio-vascular and cerebral reactions.

A clearly set out chart of instructions and protocol for dealing with adverse reactions must always be displayed in the Control area.

Effective instructions on the preparation of patients for the examinations must be generally promulgated and every effort made to see that these are strictly observed so as to avoid unnecessary repeat examinations.

Present evidence suggests that intradermal or intravenous test dosing with these media has no value in preventing severe reactions. Such tests cannot be relied upon and may themselves precipitate a fatal reaction.

Several drug houses put out printed forms giving details of the treatment of adverse contrast media reactions.

**LICENSING OF HOSPITAL PERSONNEL TO USE IRRADIATING APPARATUS**

**Possession of Irradiating Apparatus**

The Radiological Advisory Council considers that in the event of a malfunction of the apparatus which may give rise to unnecessary radiation to either staff or patients the ultimate responsibility for repairing the fault should rest with the administrative officer of the hospital. The person licensed to use the apparatus is generally in an employee position and, as such, may not be able to ensure that the required repairs or modifications are carried out.

The Chief Executive Officer, or Medical Superintendent, etc. must be licensed to possess the irradiating apparatus, but will not, unless he has special experience or training in the use of irradiating apparatus, be given a license to use the apparatus. The payment of an initial license fee or license renewal fee (renewable every 12 months) is not required.

**Use of Irradiating Apparatus**

(Excluding Fluoroscopic Apparatus and Computerised Axial Tomographic Scanners)

The policy of the Radiological Advisory Council is that all persons, except students in radiography, using irradiating apparatus for medical diagnosis must be licensed under the provisions of the *Radioactive Substances Act 1957*. This applies to radiologists, qualified radiographers, medical practitioners, and nursing staff. The use of irradiating apparatus by non licensed persons working under the direction and supervision of a person holding a license is not acceptable to Council. The issue of a license, will, in general, be restricted to those persons who have had adequate training and/or experience in the use of irradiating apparatus.
Use of Fluoroscopic Apparatus

The use of fluoroscopic apparatus is restricted to qualified radiologists, and in some cases advanced students in radiology, and also to medical specialists who require fluoroscopy in the normal course of their speciality. All persons undertaking fluoroscopy must be appropriately licensed.

BLOOD SAMPLES FOR BIOLOGICAL DOSIMETRY PROCEDURE

1. Collect 15 mL blood by venepuncture:
   (a) 10 mL into a vial containing preservative-free heparin (available from any hospital or from Radiation Health Services) for chromosome aberration analysis.
   (b) 5 mL into an EDTA vial for full blood count (send to nearest hospital for analysis or dispatch with the other sample).

   Clearly identify each vial with details of the exposed person and whether blood is for test (a) or (b) above.

2. Store blood in the refrigerator or ice pending transport. Do not freeze the sample, since this renders it useless for study.

   During transport, place samples in an “Eski” type of unit or a suitable container and surround by ice. Do not use “dry ice” as this will freeze the samples.

3. Inform Mr K. Brown (or Dr H. Panter), Radiation Biology Section, Australian Atomic Energy Commission, Lucas Heights, by telephone (Sydney 543 3060).

4. Enclose an official letter requesting that biological dosimetry (chromosome aberration analysis) be carried out on blood sample (a). The letter should include the following information relating to the exposed person:
   • his/her name;
   • a description of the suspected ionising radiation over-exposure;
   • details of the person’s previous exposure to x-rays, or other ionising radiation, for medical purposes;
   • a brief medical history of the person;
   • information on any medication currently being taken by the person;
   • details of the person’s cumulative occupational exposure to ionising radiation measured by physical dosimetry, if he/she is a radiation worker.

USE OF COMPUTERISED AXIAL TOMOGRAMS (CAT SCANNERS)

The issue of a license to radiologists to use CAT scanners is restricted to those radiologists who, in the opinion of the Radiological Advisory Council have undergone a suitable training course in the use of CAT scanners and have had several months experience working with a radiologist who holds a license to use CAT scanners.

Should any further advice be required concerning Council’s requirements please contact the Officer in Charge, Radiation Health Services, PO Box 163, Lidcombe, NSW, 2141.

LABELLING AND USE OF MARKERS IN X-RAY EXAMINATIONS
(Information Bulletin 95/38)

The Department has been made aware of instances where the appropriate labelling and use of markers in x-ray examinations has not occurred.
It is emphasised that all x-ray films should be labelled and standard markers used. The label must specify the name of the patient, the date of the x-ray and the place where the x-ray was taken.

As indicated in the Australian Institute of Radiography (AIR) Guidelines for Professional Conduct of Radiographers and Radiation Therapists, there is a professional responsibility to ensure that the markers applied to the radiograph's identify the correct side of the patient.

The most important marker, when indicated, is the left or right marker on Antero-Posterior, Postero Anterior or axial films. Other markers, such as inspiration/expiration, flexion/extension, should be used when indicated, but are not usually critical.

It may be appropriate that additional markers are made available in x-ray rooms and on mobile units. Marking of the film after the x-ray has been performed is considered unsatisfactory. If the sides are uncertain it should be reported as such.

**WORK HEALTH AND SAFETY – LIMITING STAFF EXPOSURE TO IONISING RADIATION (PD2014_026)**


**PURPOSE**

The purpose of this Policy Directive is to assist managers, in conjunction with PD2013_050 *Work Health and Safety: Better Practice Procedures*, to meet their duty to ensure that occupationally exposed staff are identified, and prevented from being exposed to ionising radiation that exceeds the dose limits set out in Schedule 5 of the *Radiation Control Regulation 2013* (the Regulation).

The Regulation defines an *occupationally exposed person* as one who is exposed to ionising or non-ionising radiation directly arising out of, or in the course of, the person’s employment.

**MANDATORY REQUIREMENTS**

NSW Health organisations must ensure that:

- Work procedures, which potentially expose staff to ionising radiation, are identified and assessed using a risk management approach as required under the *Work Health and Safety Act 2011* (WHS Act).
- Safe work practices and procedures are documented and implemented so that staff are not exposed to ionising radiation that exceeds the dose limits as set out in Schedule 5 of the Regulation.
- A Radiation Management Plan is developed in accordance with the Australian Radiation Protection and Nuclear Safety Agency (ARPANSA) *Radiation Protection in the Medical Applications of Ionizing Radiation* Code of Practice (RPS14).
- Staff who are occupationally exposed to ionising radiation are provided with information and training, as necessary, and are made aware of:
  - The hazards that can arise in connection with the use of regulated material, which is defined under the *Radiation Control Act 1990* as meaning radioactive substances, ionising radiation apparatus, non-ionising radiation apparatus of a kind prescribed by the regulations and sealed source devices.
  - The safety arrangements that exist to protect persons from such hazards and the steps the person must take in order to minimise the likelihood that such a hazard will arise.
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- The name of the person undertaking the radiation safety officer role or other persons from whom they should obtain advice in connection with any matters relating to the use of radioactive substances and radiation apparatus.

- The requirements as set out in the NSW Environment Protection Authority (EPA) Radiation Management Licence are complied with, including the Guidelines and Codes to which the licence refers.

- RPS14 is complied with in relation to occupationally exposed staff, including the provision of an approved personal radiation monitoring device as outlined in RPS14 section 3.1.9.

- All monitoring devices are checked, maintained and calibrated in accordance with the document entitled Radiation Guideline 1: Monitoring devices (clause 32 of the Regulation).

- Radiation accidents are reported, investigated and records of accidents maintained, as required under clause 37 of the Regulation.

- Faults or defects when identified are investigated and rectified and any person(s) who may have been exposed to radiation in quantities in excess of those that would normally be received are informed, as required by Clause 40 of the Regulation.

Ultrasound

- Prior to ultrasound examination, sonographers are advised by the referring clinician if a radiopharmaceutical dose has been administered to the patient (prior administration of a radiopharmaceutical is not in itself a contraindication to performing an ultrasound examination).

- Staff exposure is minimised by scheduling procedures requiring close patient contact. In general, where practicable, routine ultrasound examinations should not be performed soon after a patient has been injected with a radiopharmaceutical except in those circumstances where the wellbeing of the patient necessitates otherwise. (The clinical requirement for an ultrasound in this instance needs to be discussed with the referring medical specialist.)

Modified Barium Swallows (MBS)

- Speech pathologists and other staff participating in MBS and associated procedures using fluoroscopy must use personal protective equipment (PPE) as set out in the NSW Environment Protection Authority (EPA) Policy on X-ray Protective Clothing (2014) and good radiation practice, as set out in the EPA document Radiation Guideline 6 Part 2: Registration Requirements & Industry Best Practice for ionising radiation apparatus used in diagnostic imaging.

- For fluoroscopy procedures including MBS studies where speech pathologists, radiologists or other staff such as nurses are present inside the screening room and not behind a protective shield, a properly fitted lead apron and thyroid collar must be worn. This work practice is considered adequate for pregnant staff, provided the lead apron is properly fitted to cover the abdomen, and the radiation monitor (where applicable) is worn under the apron.

- Staff undertaking studies requiring fluoroscopic examination of the patient should receive proper training in all aspects of these studies. This should include training in radiation safety and the proper use of PPE to ensure that doses to themselves and the patient are minimised.

- X-ray equipment used for fluoroscopy procedures including MBS shall be maintained in a condition that meets the requirements for registration in NSW, and only operated by persons licensed to carry out the proposed procedure.
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IMPLEMENTATION

Roles and responsibilities:

*Chief Executives, Local Health Districts* are required to ensure:
- The mandatory standards contained in this Policy Directive are communicated to all managers and occupationally exposed staff, and implemented.

*Managers and supervisors* are required to ensure:
- They identify staff who are occupationally exposed to ionising radiation and assess and minimise or eliminate exposure to ionising radiation.
- Radiation monitoring devices and the appropriate personal protective equipment is made available to and utilised by relevant staff.
- Staff involved in work procedures that involve possible exposure to ionising radiation receive training in radiation safety and the proper use of PPE to ensure that doses to themselves and the patient are minimised.

*Staff* are required to ensure:
- They comply with the safe work practices established in their workplace.
- They wear the personal radiation monitor issued and any personal protective equipment required while involved in the use of ionising radiation.
- They report to the person undertaking the radiation safety officer role any matter which they are aware of which may compromise radiation protection.