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Radiology

Standard Operating Procedure for the Use of Contact Shielding on Patients for Diagnostic Radiology Examination

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1. Background

The use of contact shielding, generally in the form of lead rubber, has been normal practice and used for many years, applied directly to the patient to reduce radiation dose; particularly to the gonads. However recent studies have questioned the effectiveness of using such shielding ^(1,2,3) whilst others have highlighted inconsistencies in its positioning ⁽⁴⁾.

The introduction of digital technology has also substantially reduced the exposure factors needed to produce diagnostic images leading to reduced doses to the patient. This has seen the radiation weighting factor for gonads dropped from 0.2 to 0.08 ⁽⁵⁾ and so the gonads are no longer considered as radiation sensitive so the risk is decreased; meaning that the increased dose from having to repeat an examination due to incorrect positioning of the shielding is now a lot greater than that saved by using it.

A working party consisting of representatives from the British Institute of Radiology (BIR), Institute of Physics and Engineering in Medicine (IPEM), Public Health England (PHE), Royal College of Radiologists (RCR), Society and College of Radiographers (SCoR) and the Society for Radiological Protection (SRP) was established to consider the evidence and produce guidance on what constitutes best and agreed practice.

The overall findings suggest that “**contact shielding provides minimal or no benefit and professionals should concentrate on other areas of radiation protection which are more effective in optimising the patient radiation exposure**” ⁽⁶⁾. This is due to:

- Contact shielding can adversely interfere with the imaging (leading to a repeat exposure/test)
- If misplaced or allowed to move during an examination, the shielding can actually lead to increased patient radiation exposure.

2. Purpose

The Standard Operating Procedure (SOP) has been written to:

- Clarify the NDHT Radiology policy to **not use** contact shielding for patients, in accordance with National Guidance.
- To improve consistency in practice.
- To provide risk reduction and reassurance for patients undergoing diagnostic imaging procedures.

3. Scope

This Standard Operating Procedure (SOP) relates to the following staff groups who may be involved in performing diagnostic imaging procedures:

- Radiographers

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- Radiologists
- Assistant Practitioners (Radiographic)
- Radiographer Apprentices
- Student Radiographers

4. Location

This Standard Operating Procedure relates only to diagnostic imaging procedures being performed within the radiology departments at the Northern Devon Healthcare Trust; including those at NDDH Barnstaple; Bideford and District Hospital, Bideford; and the Tyrell Hospital, Ilfracombe.

Staff undertaking this procedure must be able to demonstrate continued competence as per the organisations policy on assessing and maintaining competence.

5. Equipment

All Radiology imaging equipment on the above sites including General and A+E x-ray units, AMX Mobile imaging machines, Dental imaging equipment, Mobile Image Intensifiers, Interventional fluoroscopy equipment, CT and DEXA.

6. Procedure

6.1. IR(ME)R 2017 ⁽⁷⁾

These regulations set out the fundamental principles for keeping patients safe and ensuring that patient doses are kept 'as low as reasonably practicable'. This involves managing patient dose in line with the intended medical purpose, so ensuring that the risk of having the x-ray is outweighed by the benefit of gaining a diagnosis.

The use of shielding in diagnostic imaging is guided by the supporting evidence and the focus should be on what is safest for the patient. According to the BIR guidance ⁽⁶⁾ "operators need to communicate with patients, and those who care for them, to provide adequate information in order to reach agreement on the appropriate use of shielding.

Every individual has a right to request or refuse shielding and should be supported to make their own decision; however the priority remains to achieve a suitable diagnostic image, where benefit outweighs risk. If the patient/individual chooses a course of action that might increase their risk in terms of radiation dose, it is the Operator's responsibility to take action to prevent harm ⁽⁶⁾ "; this action might include discussing the examination with the liaison Radiologist to see if the procedure should go ahead with patient contact shielding against advice and policy.

6.2. Operator Responsibilities

The Operator is an IR(ME)R entitled duty holder responsible for practical aspects of the exposure and for complying with the employer's procedures.

Operators should take care to ensure the patient understands the function of shielding and where indicated, it should be integral to the benefit risk conversation with the patient.

The Operator has a responsibility to keep the patient safe and prevent harm and so in general contact shielding should not be routinely used.

The patient or guardian has the right to request shielding and if, after receiving all of the information about the risks from the operator they insist on the use of contact shielding, this should be documented on the Computer Radiology Information System (CRIS). The operator should be respectful and non-judgemental of the individual's choice.

It should be noted that it is not recommended that contact shielding is used as a means of reassurance.

6.3. General Requirements for Patient Contact Shielding

The overall conclusion from the available evidence is that patient contact shielding is not generally required in diagnostic and interventional radiology. There are several general requirements to ensure that contact shielding is used as a last resort and not used routinely.

- Practitioners, Operators are suitably trained, entitled and competent.
- Examinations are justified.
- Optimum positioning, collimation, immobilisation and careful selection of dose factors should be used.
- It is important that the application of patient contact shielding, if required, should only take place once all other dose reduction techniques (e.g. selection of exposure factors, collimation) have been applied.
- The priority remains to achieve a suitable diagnostic image, where benefit outweighs risk.
- Staff must use their knowledge and skills to listen as well as provide adequate information to the patient if the use of patient contact shielding is requested.
- If the patient/individual chooses a course of action that might increase their risk in terms of radiation dose, it is the operator's responsibility to take action to prevent harm; this might include discussing the examination with the Liaison Radiologist.
- Every individual has a right to request or refuse shielding and should be supported to make their own decision ⁽⁶⁾.
- If contact shielding is applied this should be clearly documented on CRIS along with the reasons for doing so.

6.4. General Radiography

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The use of patient contact shielding **is not recommended** for general radiography for the majority of imaging situations therefore: **No radiation protective contact shielding should be routinely applied for examinations taking place at NDHT.**

It is especially important not to use contact shielding with the use of Automatic Exposure Control (AEC) mechanisms, as if the contact shielding obscures the AEC in any way, the result may be significantly increased dose.

Patient contact shielding **must not** be used where there is a chance that this may occur.

6.5. **Diagnostic, Interventional and Theatre Fluoroscopy**

The use of patient contact shielding **is not recommended** for fluoroscopy **and should not be used** for the majority of imaging situations. **No radiation protective contact shielding should be routinely applied for Fluoroscopy examinations taking place at NDHT.**

Scattered radiation arising and propagating inside the patient's body constitutes the main source of radiation dose to organs and this internal scatter can only be managed by good technique.

Attention should be given to angle the beam away from radiosensitive areas when possible and careful collimation to ensure sensitive areas are out of the field if possible.

6.6. **CT**

The use of patient contact shielding **is not recommended** for CT **and should not be used** for the majority of imaging situations. **No radiation protective contact shielding should be routinely applied for CT examinations taking place at NDHT.**

Special consideration should be given to referral pathways for pregnant patients undergoing CT. This should take into account the stage of pregnancy.

Alternative means of reaching a diagnosis should be excluded before consideration is given to CT examinations and providing contact shielding.

If CT is justified there are several technological measures that can be used to reduce dose during CT scans, particularly in optimising scan protocols and good patient positioning; these are discussed in the [BIR guidance](#) (chapter 9; pages 54 – 74) ⁽⁶⁾.

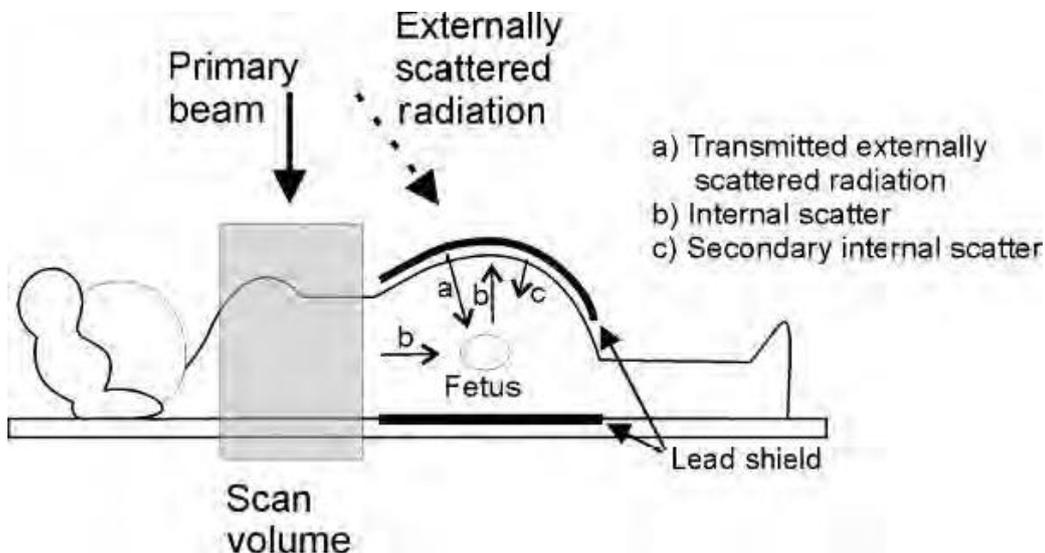
Efforts should be concentrated on positioning the patient correctly in the gantry and optimising protocol parameters, rather than using physical patient shielding either in beam or otherwise; all optimisation approaches should be considered and applied in the first instance.

Scattered radiation is the biggest risk to the foetus if radiation contact shielding is applied; in terms of the overall scattered radiation dose, the contribution to the foetus from internal scatter is about 70%, external scatter about 30%, and minimal from secondary internal scatter (see fig 1 below).

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The use of lead aprons for immobilisation of babies and children during CT scans is not advised as this will increase dose to internal organs from scatter; other immobilisation techniques or equipment should be applied.

Fig 1:



6.7. Mammography

The use of patient contact shielding **is not recommended** for mammography. **No radiation protective contact shielding should be routinely applied for Mammography examinations taking place at NDHT.**

Only the imaged breast should be subject to the primary beam; all other organs are at extremely low to negligible risk, mainly from scatter in the breast tissue and enter the trunk through the breast, and so minimising the benefit of any kind of contact shielding.

6.8. Dental Radiography

The use of patient contact shielding **is not recommended** for dental radiography. **No radiation protective contact shielding should be routinely applied for Dental examinations taking place at NDHT.**

For paediatric patients, the thyroid gland is more sensitive than for adults and so thyroid shield may provide some protection especially where the thyroid is less than 5cms from the primary beam. However, in the first instance focus should be placed on good technique.

6.9. Pregnancy

The application of contact shielding to pregnant patients during diagnostic radiography procedures is considered with regard to the potential increased dose to the foetus.

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- Radiography and Fluoroscopic Imaging of areas remote from the foetus (examinations outside of the areas between diaphragm and knee) may be carried out at any point during pregnancy with no additional patient contact shielding, provided that accurate collimation is used and that the equipment itself is adequately shielded (has UK CE mark) ⁽⁶⁾.
- Where the pelvis may be included in the primary beam, consideration should be given to the use of alternative non-ionising techniques such as MRI or ultrasound.
- If ionising radiation must be used then a thorough assessment should be carried out to ensure that exposure to the foetus is justified.
- If the exposure is justified then consideration should be given to the techniques used to ensure dose to the foetus is kept as low as reasonably practicable, e.g. minimisation of the number of views taken, strict collimation and partial shielding of the foetus.
- If the Fluoroscopy exposure is justified then consideration should be given to the techniques used to ensure dose to the foetus is kept as low as reasonably practicable e.g. pulsed fluoroscopy, storing fluoro loops, minimizing the number of views taken, strict collimation and angulation of the beam away from the foetus.

It's important to consider the psychological effect of an exposure to ionising radiation on an expectant mother. Pregnant patients undergoing diagnostic radiology examinations may request patient contact shielding despite undergoing an examination outside the pelvic region and not usually requiring extra protection.

In these cases whether or not to provide extra shielding, usually in the form of lead/lead equivalent material draped over the abdomen, is at the discretion of the radiographer; however if used should be documented and the benefit of not following NDHT policy demonstrated on CRIS.

In such cases accurate collimation must be used and the shielding must not encroach on the AEC system.

6.10. Paediatric Risk

The increased risk due to the age of paediatric patients must be considered as they have a longer life expectancy and are growing and developing quickly. There is necessarily a higher emphasis on protecting their radiosensitive organs due to the increased radio-sensitivity of the developing tissue.

Breast

Use PA projections for Chest and Spinal examinations where possible to reduce dose to breast tissue.

Thyroid

Thyroid protection is recommended where thyroid is less than 5cms from the primary beam as long as the projection is AP and it doesn't obscure the anatomy of interest; this might include Intraoral and occlusal imaging.

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Eye lens

Use PA skull positioning where possible, no recommendations for shielding.

Gonads

Shielding maybe considered in male patients where gonads are less than 5cms away from the primary beam. Not recommended for female patients due to the variable position of ovaries.

Any reduction of organ dose to radiosensitive organ tissues will reduce the risk of cancer in later life within these organs.

The specific needs of paediatric patients should be taken into consideration and techniques used to aid communication and nurture confidence (for example play specialists and distraction techniques).

The use of patient contact shielding, where indicated, must be the final step in an overarching optimisation strategy.

Shielding may be considered where a particular patient care pathway requires a number of repeat examinations, particularly in the case of paediatric patients and those on SCBU.

6.11. Managing Patient Expectations

Historical practice means that for some time there is likely to be a natural expectation that patient contact shielding is used.

Operators may need to take time to explain to the patient the rationale for not using it until this becomes normalised practice.

6.12. What if the Patient, Parent or Guardian insists on having shielding?

In the first instance the Operator should discuss the risks of giving contact shielding and NDHT policy with the Patient, Parent or Guardian.

If the Patient, Parent or Guardian insists on having contact shielding following the giving of all of the information about the risk, and contrary to the advice given by the Operator, then the patient or guardian has the right to request shielding; this should be documented on CRIS along with the rationale for doing so.

It is not recommended that contact shielding is used as a means of reassurance.

6.13. Consent

The patient must give permission before they receive any type of medical treatment, test or examination; this includes the placement of patient contact shielding.

In the rare circumstances when patient contact shielding is justified (such as where paediatrics, or those on SCBU where multiple repeated examinations will be required), the patient/guardian must be fully informed and provided with adequate information regarding the benefits and risks of using the contact shielding to enable them to make a choice.

Operators must be familiar with the legislation and professional body guidance associated with capacity and consent matters.

6.14. Other Considerations

In the rare circumstance where the use of patient contact shielding is justified, consideration should be given to equality and diversity and local populations.

Consideration should be given to:

- The use of shielding for patients who may find it difficult to cooperate.
- Careful consideration should be given to the location of reproductive organs in transgender and gender non-conforming individuals.
- Possible discomfort experienced by the patient (due to position or weight).
- Possibility of the shielding moving during an examination (due to patient age/capacity/medical condition).
- Manual handling challenges for staff.
- Infection control.
- If contact shielding **is** applied this should be clearly documented.
- Operators should also be aware of NDHT safeguarding procedures and the implications of applying patient contact shielding to areas such as the gonads in children, adults and individuals may lack capacity.

7. References

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6. British Institute of Radiology (2020) Guidance on using contact shielding on patients for diagnostic radiology applications. London; BIR.
https://www.bir.org.uk/media/414334/final_patient_shielding_guidance.pdf
7. Ionising Radiation (Medical Exposure) Regulations 2017 (No. 1322).
http://www.legislation.gov.uk/uksi/2017/1322/pdfs/uksi_20171322_en.pdf

8. Associated Documentation

Northern Devon Healthcare NHS Trust Policies for:

- [Medical Radiation Policy](#)
- [Consent Policy](#)

9. Appendix 1

Information for Parent's, Guardians or Carer's of Children undergoing X-ray or CT scan procedures in relation to the change of NDHT Policy regarding Patient Contact Shielding (Lead Apron/Gown)

In accordance with the National guidelines and local policies and procedures, patient contact shielding is not required for the x-ray examination your child will have today.

Radiation

We all receive radiation, known as 'background radiation' every day, although mankind has successfully adapted to it over millions of years; this background radiation is due to natural causes from:

- cosmic rays reaching the earth from space
- from certain rocks (which may be contained in building materials)
- from travel (particularly air flight)
- from our food
- from naturally occurring radon gas (particularly widespread in granite areas of the country such as Devon, Cornwall & Dartmoor).

In any one year our exposure will vary according to where we've lived, where we may have flown to and what we may have eaten.

Radiation in Perspective

Every X-ray we have gives us a small additional dose of radiation; the level of radiation dose varies with different types of X-ray examinations. Generally the amount of radiation you will receive during your X-ray examination is the equivalent of between a few days and a few years of exposure to natural 'background radiation' that you would receive from the environment.

Examinations such as Chest X-rays, X-rays of Limbs and Dental X-rays have doses that are relatively low and equivalent to less than 3 months background radiation and so carry a very low risk to you.

CT scans have doses that are a slightly higher and can be equivalent to 1 to 5 years background radiation depending on what area of the body is being scanned.

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Historically

It has been standard practice for many years to apply patient contact shielding for children to protect their gonads and other sensitive tissues during x-ray procedures to reduce the radiation dose that they will receive.

New Technology

The advancement of technology in the design and production of x-ray equipment, and the introduction of digital technology has meant that the exposure factors needed to produce diagnostic images have been greatly reduced to a level that means that the risk of the radiation dose to the patient is significantly reduced.

This has meant that the risk of having to repeat the exposure due to the contact shielding adversely interfering with the imaging, being misplaced or moving during an examination is now much greater than that saved by having the patient contact shielding.

National Guidance

This has now changed and the use of contact shielding is no longer recommended to be used as standard for x-ray procedures.

British Institute of Radiology (2020) Guidance on using contact shielding on patients for diagnostic radiology applications. London BIR. https://www.bir.org.uk/media/414334/final_patient_shielding_guidance.pdf

10. Appendix 2:

Information for Pregnant Patients undergoing X-ray or CT Scan procedures in relation to the change of NDHT Policy regarding Patient Contact Shielding (Lead Apron/Gown).

In accordance with the National guidelines and local policies and procedures, patient contact shielding is not required for the x-ray examination or CT scan you will have today.

Radiation

We all receive radiation, known as 'background radiation' every day, although mankind has successfully adapted to it over millions of years; this background radiation is due to natural causes from:

- cosmic rays reaching the earth from space
- from certain rocks (which may be contained in building materials)
- from travel (particularly air flight)
- from our food
- from naturally occurring radon gas (particularly widespread in granite areas of the country such as Devon, Cornwall & Dartmoor).
-

In any one year our exposure will vary according to where we've lived, where we may have flown to and what we may have eaten.

During the course of a normal pregnancy a baby is exposed to natural low dose environmental background radiation.

Radiology

Radiation in Perspective

Every X-ray or CT scan we have gives us a small additional dose of radiation; the level of radiation dose varies with different types of X-ray examinations. Generally the amount of radiation you will receive during your X-ray examination is the equivalent of between a few days and a few years of exposure to natural background radiation that you would receive from the environment.

Examinations such as Chest X-rays, X-rays of Limbs and Dental X-rays have doses that are relatively low and equivalent to less than 3 months background radiation and so carry a very low risk to you.

CT scans have doses that are a slightly higher and can be equivalent to 1 to 5 years background radiation depending on what area of the body is being scanned.

There is always concern about potential harm to the unborn child from X-Ray or CT scan radiation. The risk to you and your baby are very small and the risk of not having the X-ray could be much greater than the risk of the radiation. Birth defects, which are often believed to be the major concern, only occur with much higher dose exposure in early pregnancy i.e. the first three months. The very small risk of low dose radiation is childhood cancer.

The first detectable risk of cancer occurs when the unborn baby is exposed to a dose 20 times more than the environmental radiation, such as from the sun. At this level of exposure your baby has a 1 in 500 chance of developing childhood cancer. You would need to have more than 50 chest x-ray examinations for your baby to receive 20 times more than background radiation, or between 3 and 6 CT scans of your chest.

Historically

It has been standard practice for many years to apply patient contact shielding for pregnant patients to protect the unborn baby during x-ray procedures and CT scans to reduce the radiation dose that they will receive.

New Technology

The advancement of technology in the design and production of x-ray equipment, and the introduction of digital technology has meant that the exposure factors needed to produce diagnostic images have been greatly reduced to a level that means that the risk of the radiation dose to the patient is significantly reduced.

This has meant that the risk of having to repeat the exposure due to the contact shielding adversely interfering with the imaging, being misplaced, covering essential anatomy or moving during an examination is now much greater than that saved by having the patient contact shielding.

National Guidance

This has now changed and the use of contact shielding is no longer recommended to be used as standard for x-ray procedures and CT scans.

(British Institute of Radiology (2020) Guidance on using contact shielding on patients for diagnostic radiology applications. London BIR. https://www.bir.org.uk/media/414334/final_patient_shielding_guidance.pdf)

What will we do to keep you and your baby safe?

The risk to you and your unborn child are very small and the risk of not having the X-ray or CT scan could be much greater than the risk of the radiation.

Your Doctor or the Person that has Referred You should have already discussed the implications of radiation in pregnancy with you and any alternative means of reaching a diagnosis without x-ray or CT examinations should have been excluded.

The Radiographer is a skilled and very experienced Health Care Professional who will always work in the best interests of you and your baby. They will ensure that you have all of the information that you will need to be reassured that the risk to you or your baby during your x-ray examination is very low.

The potential harm from a repeat exposure is considered a greater risk than the exposure from scattered radiation produced during the x-ray or CT examination; the Radiographer will do everything they can to minimise the risk to your baby.

Radiation Dose from the X-ray or CT scan

All X-ray doses are kept as low as reasonably practicable to ensure that images of a high diagnostic quality are obtained without exceeding accepted dose levels.

CT scan dose to the baby is mainly from the scattered radiation during the exposure phase of the CT scan; application of external patient contact shielding can reflect this scattered radiation back to the baby as secondary internal scatter and can cause 70% of the potential dose to the baby during your CT scan. Instead reduction of scan length and optimisation of exposure factors will be used to reduce the dose to your baby.

Distance

The further the distance from the source of the x-ray the smaller the dose received; for example, if you are having your hand or wrist x-rayed you will be asked to put your wrist onto the x-ray table outstretched away from your body as this will automatically reduce the dose to your baby from scattered radiation; this is however, not possible to achieve with chest x-rays or CT scans.

Collimation

Collimation is used, in general x-rays, to limit the radiation beam to the area of interest only; this is used to ensure that the image is of optimum quality, but also to avoid unnecessary radiation dose to other organs.

The images below show how collimation works by shielding areas not wanted on the image from the primary radiation beam; for example, on the chest x-ray (below left) the abdomen and both arms are collimated off so that only the chest is included in the primary beam and radiation is reduced to other areas.

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Your Rights

You have the right to refuse your x-ray or CT scan if you feel that you don't want to have your examination done, don't have enough information to proceed or would like more time to think about it; however please be mindful that this might compromise your health or your Doctors ability to treat you; in this case you will be returned to your Doctor or the person that has referred you to discuss this further.

You have the right to request that, even with full knowledge and understanding of the risks in terms of potential increased radiation dose to your baby, you would still like to request that Patient Contact Shielding is applied then you are within your rights to do so and your wishes will be listened to without judgement; in this case the Radiographer will discuss your examination with our Consultant Radiologist and if they feel that the examination should go ahead with patient contact shielding then we will proceed.

If you have any further questions or concerns please ask the Radiographer before the X-ray or CT examination is performed.