A Radiographic Examination: justification of actions taken

The role of a radiographer is to select imaging methods which are appropriate for every radiographic examination and to determine if the radiographs produced to answer the clinical question indicated on the request form. In order for a radiographer to fulfill their role, they must be able to evaluate clinical information of patients, reason clinically, problem solve and reflect on their practice.

For this assessment, the actions of a radiographer during an observed examination will be described, explained and justified. The examination requested was that of a 50-year-old male, whose elbows were being x-rayed, in the A&E x-ray department.

Justification of why the examination was requested

Justification of a radiographic examination according to Vom et al (2017), is the process by which a practitioner evaluates the requested examination of the clinical notes to check if it's appropriate. The Ionising Radiation (Medical Exposures) Regulations (IR(ME)R 2000) states that patient exposure to ionizing radiation must not occur without prior justification. Thus before undertaking the examination, the radiographer checked the request form to ensure it was correctly filled (i.e. the right name was written on the form) and that the clinical indications and requested examinations noted were appropriate and justified. The radiographer also checked that the request was authorized (signed by a registered medical professional who is entitled to act as a referrer e.g. a Doctor, Radiologist). Under the IR(ME)R Regulations (2000), hospitals are required to provide a list of medical and non-medical referrers in all areas within the department so that the radiographer can check the request is authorized.

In this scenario, the clinical notes for the patient stated that he had fallen on his outstretched hands (FOOSH) and had a tender bilateral radial head, thus X-rays of both elbows in anterior-posterior and lateral projections were requested. The radiographer deemed the examination justified, in accordance with the International Commission on Radiological Protection (ICRP), as the exposure would be more beneficial than harmful because it enables doctors to see if there is any fracture. Knowledge of a fracture would change and improve the course of treatment for the patient thus outweighing the risk. In order for practitioners to effectively evaluate if the benefits of an exposure outweigh the risk, there must be sufficient information in the referral form. Which is why IR(ME)R (2000) demand that referrers provide enough information under clinical indication in the referral form so that the practitioner can properly determine if radiation exposure is or will be beneficial or influence patient treatment.

Positive Patient Identification check

The patient's name was called out from the waiting area and the patient was greeted upon entering the x-ray room. The operator introduced themselves and other persons in the room, to the patient as a way of establishing a friendly relationship with the patient (Whitley et al 2016). The radiographer proceeded to establish the patient's identity by asking them to state their full name, address and date of birth as per Trust Ionising Radiation (Medical Exposures) Regulations (IR(ME)R 2000) protocols. This state that the operator (individual undertaking the exposure) is responsible for the correct identification of the patient undergoing the medical exposure. The patient's response is then cross-referenced with the request form to ensure it matches and that the right individual has been identified for the examination.

The patient was also asked to confirm the fact that they did require an examination, to state which area or body part needed to be examined and also when they last had an x-ray examination. This was done as another means of ensuring correct patient identification and a means of verifying that the referral or clinical indications stated by the referrer correspond with what the patient says. The patient may have already had the same examination but the images failed to load on PACS and the practitioner could re-examine patient not knowing the examination had been previously carried out. Therefore asking the patient to confirm which body part is to be examined and when they last had an X-ray is a good practice because reduces the chance of the patient receiving excess radiation dose by ensuring the right anatomical area is examined and prevents additional, unnecessary examinations being done due to lack of communication. The Care Quality Commission (CQC) revealed in its 2013 annual reports that incorrect examinations from failed identification processes were found to have been reduced by such additional checks of clinical information and checks of previous imaging. It is also advised by the Society of Radiographer (SOR, 2016) that in addition to confirming patient's name, address, and date of birth, practitioners should also confirm clinical and information and previous imaging with patients, in order to minimize the wrong examination thus reducing patient dose and ensuring patient safety.

The whole process of the patient identification check was carried out inside the X-ray room in other to maintain the patient's confidentiality thereby abiding with the health and Social Care Council guidance on confidentiality (2017) which state that patient confidentiality should be respected and protected at all times.

Required radiation protection considerations

After checking the request form and correctly identifying the patient as per Trust IR(ME)R 2000 Procedures, the radiographer checked PACS and RIS for any previous images the patient might

have, from previous examinations in compliance with the Local Rules (2017). This enables the radiographer to determine what projections the examination should be undertaken in and if it is necessary as the patient may have already had the examination done but still sat in the waiting area. It prevents unnecessary examinations thereby reducing patient exposure to radiation.

According to Whitley et al (2016) and the local rules (2017), the X-ray doors should be shot and the radiographer position the X-ray beam is away from the door to reduce the likely hood of someone walking in during exposure thereby ensuring public safety. The patient's companion was asked to wait outside as the only ones allowed in the room during an examination are those whose presence is necessary for the examination according to the A&E departmental rules (Local Rules 2017).

Before exposure, the radiographer made certain that all persons in the room were behind the glass shield as stated by the local rules (2017). Practitioners are requested to ensure they remain behind glass shield during exposure because it is made of lead (material which can inhibit radiation particles) therefore radiation emitted from the X-ray tube cannot go through it ensuring all persons are safe from scattered radiation.

Once the examination was over, the radiographer made sure that the radiation dose received by the patient, was accurately recorded as required by the (IRR, 1999) to enable dose monitoring for patients and dose evaluation to ensure patients safety. According to the International Atomic Energy Agency (IAEA, 2016), medical radiation practice can be improved and radiation doses can be reduced without losing the diagnostic quality by constantly, accurately recording patient doses, reporting dose incidents and analyzing all data on patient doses. They also state that tracked doses for individual patients can contribute to the prevention of unnecessary exposures furthermore the information obtain can also be used in the establishment of diagnostic dose reference levels nationally or regionally.

Methods employed to reduce the amount of scattered radiation and radiation dose to the patient

Scattered radiation can be defined as photons which are scattered within the patient's body or within the detector as stated by Holmes et al (2013). It can also be defined as radiation that has been deflected off an object (e.g the detector, table, wall), from the primary beam of radiation leaving the x-ray tube. The scattered photons reduce the contrast and definition of the resulting image or radiograph. The amount of scattered produce depends on the field size or area of the patient irradiated and the Source to Image-receptor Distance (SID). Increase in scatter radiation produced reduces the quality of the image. To minimize the amount of scattered produced and to avoid unnecessary irradiation of tissue, the radiographer decreased the field size by collimating the x-ray beam to only include the area of interest for the elbow. According to Holme

(et al 2013) collimation improves image quality and reduces the radiation dose to the patient as well as the staff my minimizing scatter.

The patient was correctly positioned so that the resultant image would show the area of interest and no repeat would be needed (Whitley et al 2016). The radiographer also checked that the patient's lower limbs and torso were not underneath the imaging table and therefore not in the primary beam and gonadal shielding was also provided. All of which was done to protect the lower limbs and gonads from scattered radiation, and in turn certifying that the patient dose is kept as low as reasonably practicable (IR(ME)R 2000).

Other actions were taken by the radiographer to reduce radiation dose admitted to the patient this included preparation of the room, and setting primarily exposure before inviting the patient into the room to minimize movement unsharpness (image distortion caused by movement of patient, equipment or film movement during exposure). This reduces the likelihood of repeats thereby reducing patient dose.

Explanation of the choice of the exposure factors made and any manipulation of these that was undertaken.

The radiographer used exposure factors of 60kvp (kilovoltage) and 2 mAs (milliampere seconds) for both the anterior-posterior and the lateral projection of the elbow. According to Whitley et al (2016). KVp is the penetrating power of the x-ray beam and mAs is the amount of radiation being used. A low high kVp and low mAs was used because the patient was very slim and the area of interest was small meaning the radiation isn't going through a lot of soft tissue. Therefore, a large amount of high energy radiation isn't required as this would increase the patient's dose unnecessarily. It would also be going against IRMER regulations which state that the operator must ensure that radiation dose to the patient is kept as low as practically possible (ALARP) because all radiation is harmful and increased exposure to radiation can cause damage to the body which may be manifested later after exposure.

Whitley (2016) advices that the kVp used, should give radiation enough energy to penetrate the specific body part and reach the acquisition device. For maximum contrast to be achieved, the lowest possible contrast should be used as it allows a good amount of the radiation to penetrate a reasonable amount for the body part. Structures which are dense like the bone will absorb these low rays whereas structures of the body with a low density such as soft tissue, will absorb few of these rays, creating a large image density gradient between structures resulting in an image with high contrast.

Increasing or decreasing kVp further could have resulted in an image with less contrast decreasing image quality and bone trabeculae detail may not be visible signifying that any

abnormalities may not also be visible. As a result, a repeat would be needed which results in an increase in radiation dose to the patient. Therefore, it’s better to use a high kVp and low mAs to reduce the skin dose to the patient.

Explanation of communication strategies used

The patient was addressed at eye level to prevent the patient from feeling intimidated and to establish direct eye contact. According to.....establishing eye contact is very important because it shows interest in a conversation[AN2].

Non-technical terms or jargons and physical demonstrations were used when positioning the patient. Showing the patient how they should position themselves whilst using simple explanations, enables the patient to better understand what is being requested of them increasing the likelihood of the patient getting into the right position. This intern reduces the likelihood of the radiographer having to touch the patient and position them, which may make the patient feel uncomfortable. …….. The[AN3] use of simple speech also enables the patient to feel in control and more relaxed as they can understand what is going on.

The patient was always asked if they were capable of doing certain positions and if they felt uncomfortable or in pain once positioned. Whenever the patient was unable to do a certain position, the radiographer reassured him in a calm and polite manner. The purpose of this is to make the patient feel cared for and to help motivate the patient to comply with the treatment……[AN4]

Communication with the patient was established throughout the procedure to make sure the patient felt less anxious and also to ensure the patient did not feel like they were a disturbance or an inconvenience.

Discussion of clinical reasoning undertaken

The patient was unable to rotate his right elbow as it was too painful which meant the radiographer couldn’t position him in the recommended position for anterior-posterior elbow projection. To overcome this, the radiographer decided to do the projection using the upright Bucky. The patient was asked to stand with his back against the Bucky in the anatomical position (standing erect facing forwards, hands beside the body, feet, and palms facing forwards). The patient was encouraged to turn his palms so that they face forwards, as much as he could and the x-ray was taken. The modified technique used by the radiographer isn't one recommended by White (et al 2016), however the image produced demonstrated the distal third of the humerus, and the proximal third of the radius and ulna thereby abiding with the essential

image characteristics for an anterior-posterior elbow as stated by White (et al 2016).

Discussion of additional or alternative imaging modalities that may be used

An additional modality that may be used to image the elbow is Computed tomography (CT). This can obtain a series of images of the body in slices, which can then be used to construct a 3-Dimensional image (Adam W.M. Mitchell 2015). It can be used to diagnose a fracture and assess the full extent of the injury when or if a plain radiograph fails to do so. This is because they have the ability to show bone, soft tissues such as cartilage, and visceral organs. According to DR. Hapugoda. S (ET AL 2017) CT scanning is the best-suited imaging modality when it comes to assessing articular contour and presence of intra-articular fragments in joins. However, CT examinations involve high radiation doses and are much higher in cost, compared to plain x-rays. In addition to that, as stated by Jackson and Thomas (2005, p52), most fractures can be diagnosed with plain x-rays unless they are located in complex areas such as the shoulder, wrist, hip joint, pelvis, and ankle, where diagnosing fractures are more difficult. Thus, CT scans are only used when plain radiographs fail to show any pathology but there are reasons to believe there is one.