ASSESSMENT OF JUSTIFICATION OF X-RAY EXPOSURES IN SOME SELECTED RADIO-DIAGNOSTIC CENTRES IN A STATE IN NORTH EASTERN NIGERIA

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ABSTRACT

BACKGROUND: Justification and appropriateness of medical exposures is when the radiation dose received by patients from a procedure is expected to do more good than harm. **OBJECTIVE:** To assess justification of practice using clinical examination on patients request card. **METHOD:** The survey was conducted in six radio diagnostic centres in Gombe State Nigeria, labeled A to F for anonymity. A total number of 100 patients request cards for medical diagnostic x-ray from each of the hospitals were selected from January to April 2021 and then evaluated. The clinical history and the type of medical examination such as skull, chest, abdominal x-rays etc. were compared if it tallied with the clinical indication and examination in the standard template from IAEA on justification of exposure including referral criteria and exposure protocols guidelines. **RESULTS:** Facility C has the highest number of cases that are justified for x-ray examination 65(65%), while facility E has the highest number of unjustified cases 37(37%). Upper limb x-rays showed the highest percentage of justified cases 25 (73.5%), while skull x-ray has the highest percentage of cases that are unjustified 4 (44.4%). Age group of 45-55 years has the highest percentage of justified cases 66 (62.2%), while age group of 12-22 years has the highest percentage of unjustified cases 41 (38.3%). **CONCLUSION:** These highlight the need to improve on justification of practice to ensure adequate protection of patients, personnel and the general public from unnecessary radiation exposures.

Keywords: Justification, X-ray exposure, Request card

Introduction

The use of radiographic imaging in the management of patient is accepted globally, in fact it is deem necessary in the management of certain diseases. While it undoubtedly helps in the proper diagnosis of various disease conditions, their excessive utilization can lead to unnecessary exposure to ionizing radiation which has long term risks, the biggest of which is cancer. Therefore, the benefit of any radiographic examination should always exceed the risk, a term coined as justification.[1]

Individuals get exposed to gamma and x-radiations from various kinds of sources including industries, medical diagnostic centres etc.[2] Therefore the medical uses of ionizing radiation are among the longest established applications of ionizing radiation. The risk associated with medical use of ionizing radiation varies significantly depending strongly on the radiological procedure.[3] The referring clinicianin conjunction with the practitioner (radiologist) is responsible for ensuring that a diagnostic procedure involving ionizing radiation is justified.[4] The referring clinician collects all the clinical information that justifies the requested x-ray examination and previous clinical exposure. The information is then transmitted to the

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practitioner who, after thorough evaluation will decide on the practical aspect of the x-ray exposure.[5] The referring clinician should therefore provide sufficient medical data relevant to the medical exposure requested to enable the radiologist who is authorizing, or the practitioner, to decide whether there is a sufficient net benefit. The radiographer acting as the operator authorizing the exposure should be satisfied that the clinical information provided by the referrer is in line with the approved referral criteria (Justification guidelines).

Justification of practice is one of the cardinal principles of radiation protection as proposed by International Commission on Radiological Protection (ICRP) in its GSR part 3, 2017 publication and IAEA SSG-46. For planned exposure situations, each party with responsibilities for protection and safety shall ensure, when relevant requirements apply to that party, that no practice is undertaken unless it is justified.For emergency exposure situations and existing exposure situations, each party with responsibilities for protection and safety shall ensure, when relevant requirements apply to that party, which protective actions or remedial actions are justified and are undertaken in such a way as to achieve the objectives set out in a protection strategy.[6] However, there is increasing concern that despite the huge number of x-ray examinations conducted in clinical settings, the knowledge of justification among the referring clinician and the radiographer is inadequate.[5] So the research focus on assessing the justification of medical diagnostic x-ray exposures using patient s request forms in Gombe state, Nigeria. To the best of researcher s knowledge, the extent to which justification is adhered has not been verified in Gombe State Radiodiagnostic centres.

Materials and Methods

The study was a cross sectional survey, conducted in six private and public hospitals in Gombe state, north eastern Nigeria. The names of the hospitals were coded as A, B, C, D, E and F for anonymity. Centres B and C were private radio-diagnostic centres while Centre A, D, E and F were government owned hospitals. They were selected because their x-ray machines were functional at the time of this study and they consented to participate in the study. Ethical clearance was obtained from research and ethical committee of the Federal Teaching Hospital Gombe. Justification of practice was assessed by reviewing patients request cards based on standard template on Justification of exposure including referral criteria and exposure protocols guidelines from International atomic energy agency (IAEA), which was reviewed in March 2012.[7] A total number of 100 patients request cards from each of the hospitals were selected across all the facilities from January to April 2021 and then evaluated. The evaluation was based on the clinical history and the type of exams on the patients request card and then compared if it tallied with the clinical indication and examination in the standard template from IAEA on justification of exposure including referral criteria and exposure protocols guidelines.[7] The tallied examination was considered justified, while those that did not were then considered unjustified.

Results

Facility	Number of request cards examined	Number of cases that are justified	Number of cases that are unjustified	Number of cases with no clinical indication
A	100	52 (52%)	28 (28%)	20 (20%)
B	100	60 (60%)	29 (29%)	11 (11%)
C	100	65 (65%)	28 (28%)	7 (7%)
D	100	42 (42%)	27 (27%)	31 (31%)
E	100	53 (53%)	37 (37%)	10 (10%)
F	100	57 (57%)	17 (17%)	26 (26%)

Table 1: Justification of practice

Examination	Total	Number of justified cases	Number of unjustified cases	Number of cases with no clinical indication
Abdomen	34	16 (47%)	15 (44.1%)	3 (8.8%)
Chest	374	207 (53.3%)	13 (3.5%)	54 (14.4%)
Upper limb	34	25 (73.5%)	2 (5.9%)	7 (20.6%)
Lower limb	77	44 (57.1%)	17 (22.0%)	16 (20.8%)
Pelvic & Hip	39	18 (46.1%)	10 (25.6%)	11 (28.2%)
Cervical vertebra	12	5 (41.7%)	2 (16.7%)	5 (41.7%)
Thoracic vertebral	0	0	0	0
Lumbar vertebra	19	11 (57.1%)	3 (15.8%)	5 (26.3%)
Facial bones	2	1 (50%)	0	1 (50.0%)
Skull	9	2 (22.2%)	4 (44.4%)	3 (33.3%)

Table 2: Justification of practice for different examinations across the facilities

Age Group	Total	Number of justified cases	Number of unjustified cases	Number of cases with no clinical indication
1-11	51	27 (52.9%)	13 (25.5%)	11 (21.6%)
12-22	107	45 (42.0%)	41 (38.3%)	21 (19.6%)
23-33	119	69 (58.0%)	31 (26.0%)	19 (16.0%)
34-44	103	61 (59.2%)	26 (25.2%)	16 (15.5%)
45-55	106	66 (62.2%)	20 (18.9%)	20 (18.9%)
56-66	65	33 (50.8%)	22 (33.8%)	10 (15.4%)
67 and above	49	28 (57.1%)	13 (26.5%)	8 (16.3%)

Table 3: Justification of practice for different age groups across the facilities

Discussion

Justification of Practice

Justification in the context of medical imaging is the weighing of the expected benefit of a particular radiation procedure against its potential detriment; no ionizing radiation examination should be performed unless its expected benefit on patient outweighs its potential risk. It is the duty of the referring clinicians to ensure that all procedures involving ionizing radiation are justified and are necessary for patient s care.[4] Justified examinations are those cases that met or fall under the referral criterion that is their benefit outweighs the risk. While unjustified cases does not met the referral criteria, for example a clinician requesting a leg x-ray for an acute leg pain that is not greater than two days. Cases sent for x-ray examinations with no clinical history might be either justified or unjustified depending on the clinical condition of the patient. This can only be sorted out if the patient is re-examined by the radiologist or sent back to the clinician for proper filling of the radiology request form. Justification and appropriateness of medical exposures will help reduce the imaging costs and the dose received by the patient.[8]

The findings in this study, as depicted in (Tab.1), showed the number of patients request card evaluated from the six facilities. Facility C has the highest number of cases that are justified for x-ray examination 65(65%), while facility E has the highest number of unjustified cases 37(37%). Facility D was recorded with the highest number of cases sent for x-ray examination with no clinical indication 31 (31%).

It is important to note that justification is necessary practice in radiographic imaging; therefore the ideal is that all x-ray examinations must be deem justified before they are carry out. Study conducted by Triantopoulou et al., (2004) to evaluate the adequacy of patient data and clinical information transmitted to radiology department by referring clinicians has shown that numbers of x-ray request forms were not properly completed; therefore the diagnostic information that justifies x-ray examinations requested was not fully provided. The performance of justification in radiology is limited to the clinical information provided by the referring physicians. However, it is quite unfortunate that examination requests often lack adequate clinical information of the patient making it difficult for radiologist to practice or adequately perform justification.[9] Our result appears to corroborate earlier studies that indicate inadequate out-sending of patient s clinical information to radiology department. Considering the number of unjustified examinations in our study coupled with the significant number of requests with no clinical information and also considering results from earlier studies, it is therefore reasonable to state that the principle of justification for x-ray examination is often not adequately adhered to in the studied locations. A Greek study found that inadequate clinical information and poorly justified requests resulted in radiologists being unable to decide if requested examinations were justified.[9]

The study also found skull x-ray to have the highest number of unjustified examinations (44.4%) (Tab.2). Equally disturbing is the fact that, abdominal x-ray also found to have high number of unjustified examinations (44.1%). The higher percentage of unjustified skull examinations is not unexpected as skull x-ray is not a gold standard imaging modality for evaluation of neurological problems; they lack the ability to evaluate brain and intracranial contents. Skull x-rays are only used to evaluate skull bones fracture in case of trauma or to localized foreign body within the skull.[7] On the other hand, the prevalence of unjustified abdominal x-rays examinations may be attributed to the fact that abdominal x-rays have limited diagnostic value in emergency conditions. According research conducted by Artigas et al (2015) abdominal x-ray examinations have scant diagnostic yield in urgent disease. Most of the examinations have normal or unspecific findings.

They are usually considered as diagnostic procedure whose real usefulness is unknown.[10] This further validates our assertion that the referring clinicians and radiographers in the studied areas have inadequate knowledge of justification for x-ray examinations.

Conversely, our study also found extremities to have the highest number of justified examinations. Upper extremities have 73.5% justified examinations followed by lower extremities with 57.1%. Close observation of the studied locations showed that majority of extremities x-ray examinations are performed as a result of traumatic injuries. Researches show that plain radiography is the imaging modality for assessing fractures and dislocations in patients presenting with trauma to the extremities. Other imaging modalities such as computed tomography (CT) and magnetic resonance imaging (MRI) are not generally indicated in acute trauma unless if soft tissues pathology is suspected.[11]

Justification is a problematic practice internationally with various studies showing countries with a significant percentage of unjustified prescribed medical imaging examinations. Malone et al and Dougeni et al cite the lack of awareness and education from radiographers, radiologists and doctors as factors impeding justification. Malone et al highlighted in their report that 20-77% of examinations performed were either inappropriate or unjustified. This was due to a lack of awareness of available referral guidelines. Education of radiation dose and justification criteria has to be reinforced amongst radiologists and physicians, so that justification can result in its intended purpose of eliminating clinically non-indicated examinations.[9]

Conclusion

The practice of justification has ample clinical benefits with the current medico-legal issues. This requires radiographers to perform justification prior to every examination. However this is alas not a consistent practice across the studied facilities. The study has discovered that facility E has the highest number of unjustified cases with the age group of 12-22 years having the highest percentage of unjustified cases. These highlight the need to improve on justification of practice to ensure adequate protection of patients, personnel and the general public from unnecessary radiation exposures which can cause radiation induced effects on the body. The use of referral guidelines in radiology departments must also be encouraged across the facilities as it has been proven to help guide decision making and decrease the amount of unjustified radiographic examinations. Radiographers, who are the apparent gate-keepers between the patient and unjustified ionizing radiation, should be capable of informing the radiologist or referring physician if referrals are deemed unjustified. Since justification is a fundamental principle of radiation protection, it will help to prevent unnecessary radiation exposure by safeguarding patients from unjustified radiological examinations.

Conflict of Interest: Declared.

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