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Research Article

Quality Control Measures in Tanzania: Is it Done?

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ABSTRACT

Background: Regular implementation of a quality control (QC) programme in diagnostic radiology is vital if consistent optimal equipment performance, quality images, and accurate diagnosis at optimum radiation dose and costs are to be achieved. This highlighted the necessity for the Tanzania Atomic Energy Commission (TAEC) to establish a training programme to enable radiographers to implement a QC programme in their departments because there are no clinical medical physicists in diagnostic radiology in the country. However, the status of programme implementation is not precisely known.

Aim: The aim of this study was to investigate the status of implementation of the QC measures as performed by radiographers in diagnostic radiography departments in Tanzania.

Method: A quantitative cross-sectional survey, using a questionnaire, was conducted on a sample of 84 radiographers who had been trained in the QC programme and who were practising in 54 hospitals within Tanzania.

Results: A large number of respondents were not implementing the following QC tests: tube output, kV, mAs and timer (94%), collimation (53.5%), and densitometry and sensitometry (87.7%). The tests for film viewing box and lead rubber protective apparel were not implemented by 64.2% and 59% of the respondents, respectively. The cassette inspection and darkroom inspection were reported as being implemented by most respondents, although the testing was not observing the recommended schedule. Furthermore, the departments had no records and procedures for the QC programme, and only the locally improvized QC test tools were reported to be available.

Conclusion: The QC training objectives of TAEC have not been largely achieved because radiographers are not adequately implementing the QC programme. Without the QC programme in place, equipment malfunctioning will not be revealed at an early stage, and this can cause poor image quality and/or higher dose to patients. Therefore, active involvement of the TAEC, the ministry of health, hospital management teams, and radiographers is desirable to achieve full implementation of the programme.

RÉSUMÉ

Contexte : L'application régulière d'un programme de contrôle de la qualité est cruciale pour obtenir un rendement optimal constant de l'équipement, des images de qualité et un diagnostic exact avec une dose de rayonnement optimale et au meilleur coût. C'est pourquoi la Commission de l'énergie atomique de la Tanzanie (TAEC) a estimé nécessaire de mettre en place un programme de formation pour permettre aux radiographes d'implanter un programme de CQ dans leurs services, puisqu'il n'y a pas de physiciens médicaux cliniciens dans les services de radiologie diagnostique en Tanzanie. Cependant, le statut de la mise en œuvre de ce programme de CQ par les radiographes n'est pas connu avec précision.

But : Le but de cette étude était d'examiner le statut de mise en œuvre des mesures de CQ par les radiographes dans les services de radiographie diagnostique en Tanzanie.

Méthodologie : Une étude quantitative transversale au moyen d'un questionnaire a été réalisée auprès d'un échantillon de 84 radiographes ayant reçu la formation du programme de CQ et exerçant dans 54 hôpitaux en Tanzanie.

Résultats : Un grand nombre de répondants n'appliquent pas les tests de CQ suivants: puissance de sortie du tube, kV, mAs et minuterie (94 %), collimation (53,5 %), densitométrie et sensitométrie (87,7 %). Les tests pour la boîte lumineuse et les vêtements de protection en caoutchouc plombifère n'étaient pas utilisés par 64,2 % et 59 % des répondants respectivement. La majorité des répondants ont dit faire l'inspection des cassettes et de la chambre noire, sans toutefois respecter le calendrier de tests recommandé. De plus, les services n'ont pas de registres ni de procédures pour le programme de CQ et seuls les outils de tests improvisés localement étaient disponibles.

Conclusion : Les objectifs de formation en CQ de la TAEC n'ont pour l'essentiel pas été atteints puisque les radiographes

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n'appliquent pas adéquatement le programme de CQ. Sans programme de CQ en place, les défectuosités de l'équipement ne seront pas signalées de façon précoce, ce qui peut entraîner une mauvaise qualité des images ou des doses plus élevées pour les patients. Par conséquent, une participation active de la TAEC, du ministère de la Santé, des équipes de gestion des hôpitaux et des radiographes est souhaitable pour atteindre une pleine application du programme.

Keywords: Documentation; equipment testing; systematic implementation; quality control

Introduction

Since the discovery of x-rays in 1895, radiation has increasingly become a crucial means of medical investigations and diagnosis. The diagnostic imaging process in Tanzania involves a chain of interdependent parameters including x-ray machines, cassettes, films, darkrooms, and film processing machines. Failure in any of these components can affect the diagnostic outcome [1, 2]. Because of the complex interlinkage of these parameters, the need for consistent checking to ensure safe and effective application of the radiologic imaging system is imperative. This calls for regular implementation of a quality control (QC) programme for the diagnostic x-ray equipment. The QC programme includes commissioning tests at the time of equipment installation, routine testing to monitor equipment performance in the course of its use, and the status and/or full testing performed at longer intervals [3]. To achieve effectiveness, the QC should be performed on all equipment at recommended frequencies [4]. Also, procedures and records of the testing programme have to be available. Without a proper QC in place, patients may not obtain a timely and accurate diagnosis, with the potential of receiving additional harmful yet unnecessary radiation [5, 6].

The need for implementation of the QC in Tanzania (located in East Africa) is apparent as the radiology facilities in the country have to ensure accurate and timely diagnosis at reduced radiation dose to patients. Furthermore, implementation of the QC programme is important for unification of x-ray services nationally and internationally [5]. The *Atomic Energy Act No.7 of 2003* and the Atomic Energy (*Protection from Ionising Radiation*) *Regulations*, *2004*, of the United Republic of Tanzania require licensees and registrants to implement the QC programme. Furthermore, the licensees and registrants are required to appoint one of radiation workers as Radiation Safety Officer (RSO) whose responsibilities include organizing and implementing a Quality Assurance (QA) and/or QC programme at the facility [7, 8]. To complement compliance to the regulations, training courses for RSOs are conducted by the Tanzania Atomic Energy Commission (TAEC), a national regulatory authority. For medical radiography practices, the QC training involves radiographers because they are one of the qualified experts practising in the medical imaging facility and are responsible for using the x-ray imaging equipment [9, 10]. QC implementation by radiographers is supported by the World Health Organization, which recommends the delegation of routine QC testing to the radiographers for successful implementation [11].

The training covers radiation safety and a protection programme that includes the QC. The topics covered in QC include the following [12]:

- General checks and cleanliness of equipment,
- Film processor performance tests,
- Film condition, sensitometry, and densitometry tests,
- Cassette condition and cleanliness,
- Cassette screen-film contact and combination tests,
- Darkroom and safelight condition tests,
- Collimation and beam alignment tests,
- Lead protective gear checks and tests,
- Viewing box and/or illuminator checks and tests,
- kV and timer accuracy and reproducibility tests,
- mA/mAs reproducibility and/or reciprocity and linearity tests,
- Radiation output reproducibility tests,
- QC guidelines, procedures and record keeping.

Each of these listed topics is considered to have an impact on equipment performance, image quality, and patient dose and can also affect worker safety. Although such requirements are stipulated by regulations, the implementation of a QC programme is not mandatory for license acquisition because the verification of physics-related parameters is covered during the regulatory inspections. However, the establishment of procedures and records keeping is mandatory for keeping a license.

The trainings have been in place for almost 20 years, and more than 60 percent of the 400 hospitals with radiology facilities have radiographers trained in QC implementation. However, the status observed at some of the radiologic facilities raises concerns about the extent to which the QC programme is implemented. A previous study on the status of x-ray machines in the country revealed inadequate record keeping, misplaced and missing operational and maintenance manuals, and that 53% of the surveyed machines were defective [5]. In another study, the patient dose variations were up to a factor of five for the same type of x-ray examination within the same hospital or between hospitals. The study pointed out that the dose variations were caused by unoptimized operational conditions [13]. Furthermore, the experience from regulatory inspections have also revealed equipment faults (poor collimation, poor console indications, kV, and time inaccuracies and inconsistencies leading to dose variations and poor image quality), unsatisfactory work environments such as light leakage in darkrooms, and lack of work procedures. In some hospitals,