

Importance of Quality Assurance Program Implementation in Conventional Diagnostic Radiology

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ABSTRACT

Diagnostic radiology's basic task is to provide high quality diagnostic image information about anatomic detail or ongoing physiological process within patient's body, where such information can not be provided using alternative diagnostic method which excludes the use of ionizing radiation. Ensuring adequate clinical diagnostic information together with the least possible exposure of the patient to radiation (As Low As Reasonably Achievable – ALARA principle) at the lowest costs is quality assurance (QA) program's main goal – optimization of radiological practice. Implementation of QA program does not mean just meeting legal requirements regarding quality control (QC) of X-ray and associated equipment and areas where they are installed but also implies optimum use of equipment, human and material resources inspected through film rejection analysis and monitoring of patient doses received in particular radiological diagnostic examinations. In Republic of Croatia QA program in diagnostic radiology has not been yet systematically implemented in any medical institution. Except for legally bounded QC of X-ray equipment, other aspects of QA program are not conducted due to many reasons such as lack of educated staff and adequate measuring equipment, absence of obligatory legal acts, poor financial situation in Croatian health care system and many others. Implementation of QA program in diagnostic radiology departments of Croatian medical institutions is an imperative in order to harmonize the good practice with other countries in EU.

Key words: quality assurance program, quality control, patient dose assessment, dose reference levels

Introduction

The World Health Organization (WHO) has defined quality assurance (QA) in medical radiological diagnosis as: »... an organized effort by the staff operating a facility, to ensure that the diagnostic images produced by the facility are of sufficiently high quality so they consistently provide adequate diagnostic information at the lowest possible cost and with the least possible exposure of the patient to radiation«¹.

The basic task of medical diagnostic radiology is to provide high quality diagnostic image information about any process or anatomical detail within the patient's body. Providing the best possible diagnostic information while the dose which the patient receives is kept to a minimum – ALARA principle (As Low As Reasonably

Achievable), is the basic aim of QA program – optimization of radiological practice.

In today's modern medicine a large number of different radiological diagnostic procedures are performed in which patients sometimes receive a significant doses of radiation where the costs of radiological services regarding the equipment and resources needed are high and rising. The imperative of establishing and implementing a quality assurance program includes not only fulfilling the requirements on the technical performances of the equipment (accuracy and repeatability of X-ray tube high voltage, mAs values, collimation and beam alignment, etc) required by the law, but also optimum use of equipment and other resources – primarily monitoring of pa-

tient doses received in particular type of radiological diagnostic examinations and film reject analysis. Given that the poor quality of radiological diagnostic images, which as a result often has a repetition of radiographs – is the major cause of unnecessary patient exposure, the main component of the QA program is evaluation of image quality and identifying the cause of poor quality images and the determination of doses that patients receive in particular diagnostic procedures – a step toward establishment of dose reference levels (DRLs). In its Publication 73² International Commission for Radiological Protection (ICRP) recommends the use of diagnostic reference levels for patients undergoing common diagnostic procedures as a measure for the optimization of protection in medical exposures. The existence of such local dose reference levels (reference levels obtained in certain radiological department) allows comparison among similar radiological departments in other institutions and established national and international dose reference levels as a rating of quality of radiological practice.

Implementing a Quality Assurance Program

The basic requirements that implementation of such a program must provide are: – diagnostic images of optimum quality that enables resolution of details according to the desired standard for the type of radiological examination³⁻⁸; – doses to patient and staff must be kept to the minimum with regard to type of clinical examination undertaken and in accordance with the recommendations³⁻⁸; – maximization of financial efficiency of radiological practices by minimizing losses of human effort and material resources; – satisfaction of legal requirements to protect against radiation, referring to the use of radiation for medical purposes.

For successful establishment and implementation of QA program is essential to ensure good cooperation among experts (usually the radiologist, radiographer and medical physicist) forming so called QA program implementation committee (the Committee) which will be responsible for QA program and procedures, implementation of it, collection of data, analysis and evaluation of the results on the basis of which decision on measures to be undertaken to correct the deficiencies. The program must include written guidelines about goals that wish to achieve, work instructions and procedures for implementing actions of all staff involved in QA and administrative procedures that will ensure the control and efficiency of the implementation i.e. the regularity and validity of the performance of the required procedures.

It is very important that all the staff in the X-ray department participate in the program where the program's goal of and the responsibilities of each employee must be explained and understood in detail.

The implementation of QA program is conducted in two phases⁸: 1. setting up the QA program; 2. continuing the QA program.

Setting up the program – phase which can take different period depending on the size of the radiological de-

partment, workload, the number of employees involved etc., includes: –the establishment of the QA program implementation committee; – detailed information of all employees involved about the program, their duties within the framework of the program implementation; – overview of the current status by conducting film reject analysis and patient dose surveys; – undertaking quality control tests of all equipment that is used (X-ray tubes and generators, tomography systems, image intensifier systems, automatic exposure control systems, automatic processors, films, screens, cassettes, darkrooms and film storage conditions, film viewing conditions, etc.)⁹

On the basis of results obtained, the Committee will evaluate and determine the deficiencies in equipment and procedures that affect the quality of the images, patient doses and wastage of resources (human and material). The Committee will decide appropriate corrective actions to be performed to remove deficiencies and reach the desired standard.

Continuing the QA program is a set of activities carried out permanently to maintain quality proceeding and includes: – establishment of routine checks of equipment that require frequent monitoring (automatic processors, film storage, X-ray tubes and generators, image intensifiers etc.); – establishment of routine checks of equipment requires less frequent monitoring (alignment and collimation of X-ray tubes, tomography systems, screens/cassettes, viewing conditions, automatic exposure control systems, etc.).

It is extremely important that all the measuring devices used for routine controls are reliable, and preferably calibrated. Figure 1 presents different measuring equipment used for QC.

Any malfunction or abnormal performance of radiological equipment that is obtained in routine checks is to be further examined, corrective actions taken and re-tested. Records of the results of such routine tests are to be kept and available for future reference and possibility of use in a variety of national researches.



Fig. 1. Some measuring equipment used for QC.

Efficiency of the QA program is performed through periodical film reject analysis, measurements of doses that patients receive in particular radiological diagnostic procedures, as well as analyses of the services costs, maintenance and materials used in the radiological department. Also, the comparison of local dose reference levels with national or international dose reference values is a good indicator quality of practice.

Situation in Croatia

In Croatia, a QA program is not systematically implemented in medical institutions which perform radiological diagnostics. There is an ongoing expert project in a few Croatian hospitals whose objective is establishing local DRLs, for particular radiological diagnostic procedures, and comparison with international standards¹⁰. Development and implementation of QA program in these hospitals was the first step and the baseline towards establishing local DRLs and evaluation of radiological practice by comparison with Guidance Levels (GLs).

There are many reasons why QA program is not established and implemented in Croatian medical institutions. The most common cause is lack of adequate professional staff needed to implement such a complex process, especially trained medical physicists. In our health care system medical physicists are involved solely in radiotherapy and nuclear medicine. So far any medical physicist has not been employed in diagnostic radiology department of any Croatian medical institution. Another obstacle lies within a fact that there are no unemployed medical physicists in labor market which presents a great problem for radiotherapy and nuclear medicine departments. Regular annual, lawfully obligatory QC of X-ray equipment^{11,12} is performed by medical physics experts from outdoor services but they can not perform routine checks and patient dose measurements required by QA program. Lack of adequate binding legal regulations presents an excuse why every effort aimed towards starting with QA within medical institutions fails. Although, due to present medical institutions budget limitations, even if such legal obligation existed it is not likely that all the measuring equipment needed for routine QC and patient dose measurements would be acquired. Some measuring equipment could be received through regional scientific and technological projects but that is just a part of solution and it is not applicable to larger number of institutions. The problem of supplying and calibrating of test equipment would be solved only when they would be included in medical institution's budget. Since implementation and success of any QA program strongly depends on good cooperation of all the

staff of the X-ray department, lack of good will and enthusiasm for part of personnel involved, especially in departments with heavy workload, are very often and present an obstacle for setting up the program.

National reference dose levels are not yet established although Croatia as future EU member state would be obliged by Council Directive 97/43/EURATOM¹³ of 30 June 1997. The Member States are obliged before 13 May 2000:

1. to promote the establishment and the use of diagnostic reference levels for radio-diagnostic examinations having regard to the European diagnostic reference levels, where available;
2. to ensure that patient dose assessments are implemented by the holder of the radiological installation;
3. to ensure that a system of inspection is established to control the patient doses with respect to these reference levels;
4. to ensure that appropriate local reviews are undertaken whenever diagnostic reference levels are consistently exceeded, and that corrective actions are taken, where appropriate.

Conclusion

Implementation of quality assurance is a complex and demanding process and has to be supported by legal Regulatory bodies of the country. Effective QA program in diagnostic radiology enables the achievement and maintenance of obtaining radiological information of appropriate quality for the purposes of medical diagnosis, minimizing doses received by patient and medical personnel compatible with the type of clinical examination undertaken and the optimization of costs by cutting losses of time and resources. Improvement of professional and public reputation of radiological department as a result of education and active work approach is also not negligible.

Monitoring of patient doses is enables to optimize radiological practices, image quality analysis and consistent application of justification principles would significantly reduce the total collective dose of the population of exposure to medical radiation sources.

QA implementation in radiological departments of Croatian medical institutions will be a long lasting process due to various problems presented earlier. Only good collaboration among legal authorities, medical institution's administration and all the staff of radiological department together with support of international agencies, such as IAEA, could enable us to proceed in the direction of improving the situation and produce useful results.

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NUŽNOST PROVEDBE PROGRAMA OSIGURANJA KVALITETE U KLASIČNOJ DIJAGNOSTIČKOJ RADIOLOGIJI

S A Ž E T A K

Osnovni zadatak dijagnostičke radiologije je pružanje kvalitetne dijagnostičke slikovne informacije o anatomsom detalju ili nekom procesu unutar tijela pacijenta, pri čemu se takva informacija ne može dobiti nekom drugom dijagnostičkom metodom koja isključuje uporabu ionizirajućeg zračenja. Osiguranje najbolje moguće kliničke dijagnostičke informacije uz minimiziranje doze koji primi pacijent (ALARA princip) i troška provedbe procedure, osnovni je cilj programa osiguranja kvalitete – optimizacija radiološke prakse. Provedba programa kvalitete ne podrazumijeva samo zadovoljenje zakonskih uvjeta na kontrolu kvalitete rendgenskih uređaja i opreme te prostora gdje su oni smješteni već nalaže i optimalno korištenje opreme, ljudskih i materijalnih resursa što se potvrđuje kroz analizu odbačenih filmova te praćenjem doza koje prime pacijenti u određenim radiološkim dijagnostičkim postupcima. U Republici Hrvatskoj program osiguranja kvalitete u dijagnostičkoj radiologiji nije sistematski uveden u niti jednu medicinsku ustanovu. Osim zakonski obvezne kontrole kvalitete rada rendgenskih uređaja ostali aspekti programa osiguranja kvalitete se ne provode zbog različitih razloga kao što su nedostatak educiranog kadra, potrebne mjerne opreme, nepostojanje obvezujućih zakonskih propisa, lošeg financijskog stanja u sustavu zdravstva itd. Uvođenje programa osiguranja kvalitete u radiološke odjele medicinskih ustanova u Hrvatskoj predstavlja imperativ u cilju približavanja kvaliteti rada ostalih zemalja Europske unije.