

# Fluoroscopy: Image Quality and Analysis



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# Fluoroscopy: Image Quality and Analysis

Anne Scott, BSRS, R.T.(R)

*The diagnostic quality of radiographic images obtained during fluoroscopy studies depends on multiple factors, including patient positioning, selection of exposure technique, patient preparation, removal of artifacts and appropriate use of image processing equipment and software. Fluoroscopy operators, including radiographers and radiologist assistants, must be able to distinguish sources of error during image acquisition and determine ways to improve image production and quality. Radiology personnel should follow established departmental standards for image acceptance to prevent unnecessary repeat exposures and to provide the radiologist with the most useful images for interpretation.*

## After completing this article, readers should be able to:

- Describe the role of the radiographer and radiologist assistant in image quality and analysis.
- Identify the factors used to evaluate image quality.
- Summarize the importance of proper positioning.
- Discuss the effects of patient preparation on the resulting radiographic image.
- Differentiate between technical factors, procedural factors and equipment malfunctions that affect image quality.

**F**luoroscopic imaging typically is used to demonstrate real-time, dynamic processes; however, fluoroscopy equipment also can acquire static images if necessary to capture a permanent record of an anatomical area or abnormality. Several types of image recording technologies are available for fluoroscopy, including spot film devices, automatic film changers, photofluorography, digital fluorography, cine fluorography and video recording. Each recording method has different characteristics that affect image quality in terms of spatial resolution, contrast and noise.<sup>1</sup>

Additionally, there are different fluoroscopy equipment configurations designed for specific uses, including standard radiography/fluoroscopy combination units, fixed C-arm units and portable C-arm equipment. Because each type of equipment has distinct limitations, imaging personnel should receive specific training for their fluoroscopy systems and the use of postprocessing tools to produce the best possible images.<sup>1</sup>

Despite the variety of fluoroscopy

equipment, imaging standards have been developed to help ensure diagnostically useful studies are produced, regardless of the equipment configuration or image recording device used. Standards pertaining to medical image quality are necessary to optimize the diagnostic usefulness of radiographs and to minimize radiation exposure caused by repeat imaging examinations.<sup>2</sup> Each imaging facility has its own standards for acceptability; therefore, fluoroscopy operators must be aware of their individual organization's requirements for performing repeat examinations, even as they work to produce the best possible images.<sup>3</sup>

High-quality images demonstrate the following characteristics:

- Maximum recorded detail.
- Optimum patient positioning.
- Excellent penetration, contrast and density.
- No motion or removable artifacts.<sup>3</sup>

The radiographer or radiologist assistant (RA) should examine all images for quality before they are submitted to the radiologist for interpretation.

### The Role of the Radiographer

Radiographers may perform noninterpretive fluoroscopic procedures and assist licensed practitioners with fluoroscopic and specialized interventional imaging procedures, when appropriate and in accordance with state statutes.<sup>4</sup> The American College of Radiology (ACR) suggests that technologists receive formal training in radiation management and complete a formal credentialing process administered by the facility for assisting with interventional procedures.<sup>5</sup> In the United Kingdom, radiographers frequently are trained to perform double contrast barium enema examinations, and research reports that radiographers produce studies that are comparable to radiologist-managed studies.<sup>6</sup>

According to the American Society of Radiologic Technologists (ASRT) Radiographer Scope of Practice, the technologist is responsible for the following parts of the medical imaging procedure:

- Reviewing the patient's clinical history to ensure the proper imaging procedure has been ordered.
- Preparing the patient for the procedure.
- Selecting the proper imaging equipment and associated accessories.
- Positioning patients to best demonstrate the anatomy of interest.
- Immobilizing patients as necessary.
- Preparing and administering medications, such as contrast agents, prescribed by a licensed practitioner.
- Determining the radiographic exposure technique, while applying principles of radiation protection to the patient and staff.<sup>4</sup>

Following image acquisition, the radiographer should evaluate the images before submitting them to the radiologist. Images should demonstrate proper patient positioning, appropriate anatomy and overall satisfactory image quality, and the technologist should determine if additional images might improve the overall diagnostic value of the procedure. If additional images are obtained, the technologist must record the justification for the repeated images. Radiographers also should develop and maintain a technique chart for imaging equipment, including fluoroscopy systems, to minimize repeats caused by exposure error.<sup>4</sup>

### The Role of the Radiologist Assistant

The ASRT *Radiologist Assistant Practice Standards* defines an RA as, “an advanced-practice radiographer who practices under the supervision of a radiologist and enhances patient care in radiology service.”<sup>7</sup> The RA exercises independent professional judgment when performing patient assessment, patient management and procedures in medical imaging and interventional radiology, including fluoroscopy.<sup>7</sup>

According to the American Registry of Radiologic Technologists (ARRT), a registered radiologist assistant (R.R.A.) is responsible for evaluating images for completeness and diagnostic quality, as well as recommending additional images when necessary, as long as they are obtained using the same modality. An RA also assesses images for diagnostic utility and reports clinical findings and initial observations to the supervising radiologist. If there are exceptions to the expected outcome of a procedure, the RA must document those exceptions in a timely, accurate and comprehensive manner and may be required to devise a new plan of action to reach the intended outcome. If the RA develops a revised action plan, the RA must share the plan with the appropriate radiology team members.<sup>7</sup>

Part of the RA's responsibility for ensuring image quality is to confirm that equipment performance and maintenance meets the manufacturer's specifications.<sup>8</sup> The RA may perform quality assurance activities to assess equipment performance and radiology department processes. RAs also may be required to document these activities and request equipment repair or maintenance.<sup>8</sup>

In the United Kingdom, the trend for advanced radiographers has been to interpret diagnostic imaging studies and report their impressions. One study found that radiographers reported results of film-screen radiography in 46% of hospitals and barium enemas in 45% of hospitals.<sup>9</sup> It is important to note that the ACR, the ARRT and the ASRT do not support this trend.<sup>9</sup>

The ACR maintains that the RA may make initial observations of diagnostic studies and forward those remarks only to the supervising radiologist,<sup>5</sup> but RAs may not perform interpretations of radiological exams.<sup>10</sup> RAs, however, can communicate the radiologist's findings to the referring physician.<sup>9,10</sup>