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Digital Fluoroscopic Imaging: Acquisition, Processing and Display

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ABSTRACT:

The modern digital fluoroscopic imaging system has evolved to levels of complexity and automation that, when properly applied, can provide enhanced clinical performance and flexibility over a wide range of clinical applications in a user-friendly manner. However, achieving maximum performance from such complex systems may be best achieved through cooperative efforts between manufacturers and clinical users, in which the well-informed clinical team can utilize the degrees of freedom available in these systems to achieve the best clinical results for each medical application of interest. The medical physicist plays an important role in this process as the person who understands the relationships between physical imaging parameters, dose, and clinical imaging performance. Therefore, an understanding of system architectures, design philosophies, image processing capabilities, and degrees of freedom in procedure programming allow the medical physicist to play a more effective role. To this end, an overview of modern digital fluoroscopic imaging system will be presented, with particular attention given to the range of fluoroscopic and record imaging modes provided, automatic exposure control systems, common image processing algorithms, and procedure protocol selections. Recommendations for minimizing pitfalls in equipment testing will also be presented, along with some of the unique considerations for flat panel detectors versus image intensifier-based imaging systems.

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EDUCATIONAL OBJECTIVES:

Understand the architecture of modern fluoroscopic systems, including major image and data communication pathways, control systems, and image processing from acquisition to display.

Gain familiarity with the flexibility in control and processing afforded by new technologies and architectures, and how manufacturers use these.

Be aware of the various fluoroscopic imaging modes and the related image quality and dose considerations, including dose monitoring and reporting.

Understand common image processing techniques, such as edge enhancement, multiband filtering, and temporal filtering, and their impact on image quality.

Recognize the unique aspects of Digital Flat Panel Detectors and the related implications for fluoroscopic system behavior and performance.

Be able to identify the types of automation implemented in systems, and know how to avoid related pitfalls in testing.

Recognize the various procedure protocol programming capabilities available, and how they may be customized to meet clinical objectives.