AI Technology Reduces Radiation Exposure during Endoscopic Procedures

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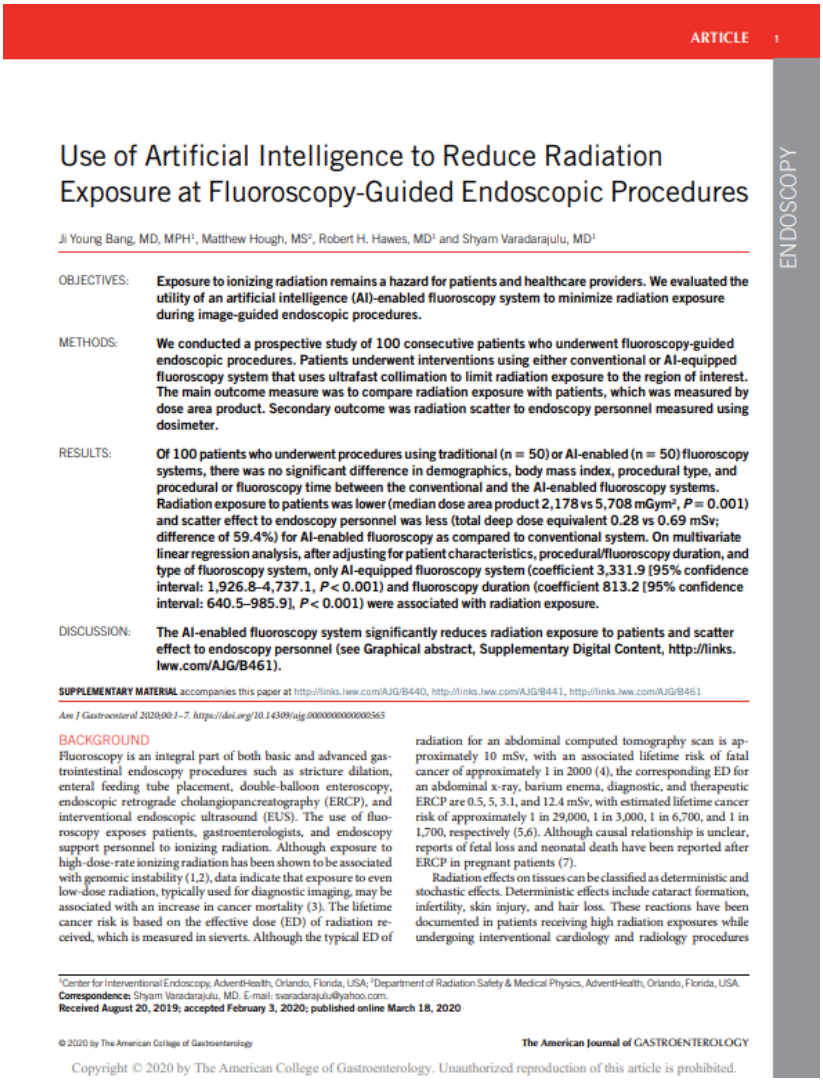

Use of Artificial Intelligence to Reduce Radiation Exposure at Fluoroscopy-Guided Endoscopic Procedures

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OBJECTIVES: **Exposure to ionizing radiation remains a hazard for patients and healthcare providers. We evaluated the utility of an artificial intelligence (AI)-enabled fluoroscopy system to minimize radiation exposure during image-guided endoscopic procedures.**

METHODS: **We conducted a prospective study of 100 consecutive patients who underwent fluoroscopy-guided endoscopic procedures. Patients underwent interventions using either conventional or AI-equipped fluoroscopy system that uses ultrafast collimation to limit radiation exposure to the region of interest. The main outcome measure was to compare radiation exposure with patients, which was measured by dose area product. Secondary outcome was radiation scatter to endoscopy personnel measured using dosimeter.**

RESULTS: **Of 100 patients who underwent procedures using traditional (n = 50) or AI-enabled (n = 50) fluoroscopy systems, there was no significant difference in demographics, body mass index, procedural type, and procedural or fluoroscopy time between the conventional and the AI-enabled fluoroscopy systems. Radiation exposure to patients was lower (median dose area product 2,178 vs 5,708 mGym², $P = 0.001$) and scatter effect to endoscopy personnel was less (total deep dose equivalent 0.28 vs 0.69 mSv; difference of 59.4%) for AI-enabled fluoroscopy as compared to conventional system. On multivariate linear regression analysis, after adjusting for patient characteristics, procedural/fluoroscopy duration, and type of fluoroscopy system, only AI-equipped fluoroscopy system (coefficient 3,331.9 [95% confidence interval: 1,926.8–4,737.1, $P < 0.001$) and fluoroscopy duration (coefficient 813.2 [95% confidence interval: 640.5–985.9], $P < 0.001$) were associated with radiation exposure.**

DISCUSSION: **The AI-enabled fluoroscopy system significantly reduces radiation exposure to patients and scatter effect to endoscopy personnel (see Graphical abstract, Supplementary Digital Content, http://links.lww.com/AJG/B461).**

SUPPLEMENTARY MATERIAL accompanies this paper at http://links.lww.com/AJG/B440, http://links.lww.com/AJG/B441, http://links.lww.com/AJG/B461

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BACKGROUND

Fluoroscopy is an integral part of both basic and advanced gastrointestinal endoscopy procedures such as stricture dilation, enteral feeding tube placement, double-balloon enteroscopy, endoscopic retrograde cholangiopancreatography (ERCP), and interventional endoscopic ultrasound (EUS). The use of fluoroscopy exposes patients, gastroenterologists, and endoscopy support personnel to ionizing radiation. Although exposure to high-dose-rate ionizing radiation has been shown to be associated with genomic instability (1,2), data indicate that exposure to even low-dose radiation, typically used for diagnostic imaging, may be associated with an increase in cancer mortality (3). The lifetime cancer risk is based on the effective dose (ED) of radiation received, which is measured in sieverts. Although the typical ED of radiation for an abdominal computed tomography scan is approximately 10 mSv, with an associated lifetime risk of fatal cancer of approximately 1 in 2000 (4), the corresponding ED for an abdominal x-ray, barium enema, diagnostic, and therapeutic ERCP are 0.5, 5, 3.1, and 12.4 mSv, with estimated lifetime cancer risk of approximately 1 in 29,000, 1 in 3,000, 1 in 6,700, and 1 in 1,700, respectively (5,6). Although causal relationship is unclear, reports of fetal loss and neonatal death have been reported after ERCP in pregnant patients (7).

Radiation effects on tissues can be classified as deterministic and stochastic effects. Deterministic effects include cataract formation, infertility, skin injury, and hair loss. These reactions have been documented in patients receiving high radiation exposures while undergoing interventional cardiology and radiology procedures

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In a prospective study presented to The American Journal of Gastroenterology (AJG), Ji Young Bang MD, MPH, Matthew Hough MS, Robert H. Hawes MD, and Shyam Varadarajulu MD evaluated the utility of an AI-enabled fluoroscopy system to minimize radiation exposure during image-guided endoscopic procedures.

The results of the study conclusively showed that AI-enabled fluoroscopy systems significantly reduce radiation exposure to patients and scatter effect to physicians and staff. The dose area product (DAP) was 61.8% lower (2,178 vs 5,708 $mGym^2$) while the scatter radiation to staff was 59.4% lower 0.28 vs 0.69 mSv) using the AI system compared to the conventional non-AI system.

Fluoroscopy is an integral part of many endoscopic procedures. It provides the real-time imaging physicians need to perform advanced procedures. But that same technology presents a risk of radiation exposure to the patient as well as the physician and staff.

The risks of radiation exposure are well documented. During procedures, there are two main sources of radiation – the instant beam which is the main source of radiation to the patient and scatter radiation that emanates from the patient's body. We have discussed scatter radiation during endoscopy in a previous article. But how can technology also help to reduce the risk to everyone in the lab that radiation exposure presents?

Conventional (non-AI) imaging systems deliver radiation to the entire field of view (FOV). In contrast, AI imaging systems confine radiation exposure to the region of interest (ROI). Peripheral areas, the FOV, receive significantly less radiation – what's required for reference and orientation.

The fluoroscopy systems designed and built by Omega utilize advanced AI-enabled technology that takes radiation safety to a new level – creating a new standard of care and obsoleting systems without this technology. Omega systems provide an automatic, hands-free solution to radiation reduction – delivering the benefit of proven radiation reduction to patients and staff beyond anything else in use today.

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