

Managing Procedural Reality: Artificial Intelligence in Interventional Radiology



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Purpose

Artificial intelligence (AI) in radiology has largely focused on diagnostic interpretation, yet its most immediate and transformative impact may be within procedural practice.

Interventional Radiology (IR) operates at the intersection of imaging, clinical decision-making, and real-time intervention, creating a distinct need for AI tools that support patient selection, prognostication, administrative automation, procedural planning, intra-procedural support, and follow-up.¹

This study reframes AI as a peri-procedural instrument and examines how IR leaders can responsibly integrate AI into clinical workflows while maintaining professional ownership, accountability, and patient safety.

Methods/Materials

This leadership-focused review synthesizes current AI taxonomies, real-world IR use cases, and evidence from surgical specialties that have successfully operationalized AI. Workflow domains evaluated include consult triage, scheduling, procedural planning, intra-procedural guidance, documentation, and longitudinal outcome assessment. Lessons from surgery are analyzed to identify transferable leadership strategies related to governance, training, cultural adoption, and performance oversight.

AI Taxonomies

Current AI taxonomies provide a practical framework for understanding AI as an orchestra of instruments rather than a single technology. These instruments assist – not replace – the clinician. Each AI application supports different tasks, use different data inputs, and generate different types of outputs. Predictive analytics, computer vision, natural language processing, generative AI, automation, and decision-support systems each have different strengths, limitations.

Taxonomy organization helps clinicians judge workflow fit, actionability, and contribution to safe, efficient, meaningful care delivery.

Workflow fit

Referral intake, consult triage, patient selection

Here predictive analytics, natural language processing (NLP) can assist in supporting referral prioritization, identify incomplete work-ups, flag urgent findings and route patients to appropriate IR clinic or procedural pathways². The value here is systems improve access, reduce delay, standardizes referral pathways and supports appropriate utilization.

Scheduling, Resource Allocation, Procedural Planning

Administrative automation, operations analytics, segmentation tools and virtual reality, here, optimizes room use, anticipate case complexity, device planning, map anatomy and assist in strategy. As a result there is improved efficiency, resource allocation, procedural readiness and increased throughput.

Intra-procedural support

Image registration, navigation support and real-time analytics during the procedure assist the operator with target localization, tool tracking, dose awareness, image guidance and decision-making. Overall, these processes enhance safety, precision, consistency and procedural completion while keeping the physician as the primary operator.

Documentation & Follow-up

NLP, generative AI, ambient documentation, coding automation and surveillance tools provide value by reducing administrative burden, improve charge capture and standardize communication by generating structured reports, support coding, reduce time in documentation and identify complications.

Outcomes & Governance

Registry analytics, dashboards, audit systems and model-monitoring tools provide longitudinal oversight. These systems track outcomes, complications, radiation dose, patient-reported outcomes (PRO), bias, model drift and workflow impact of established and/or new providers. From the leadership value perspective, these instruments here enable quality improvement, accountability, safety oversight, ROI assessment and responsible AI adoption.

Real world IR use cases

Patient selection

Abajian et al.³ used ML techniques to predict therapeutic outcomes of transarterial chemoembolization (TACE). In the study, models predicted treatment response with an accuracy of 78%. The strongest clinical and imaging predictors were cirrhotic morphology and tumor MR signal intensity.

Intraprocedural robot-assisted, AI-based needle guidance

Sato et al.⁴ demonstrated an AI system can detect all target lesions and generate an appropriate needle path. The robot-assisted significantly reduced insertion time while maintaining sufficient accuracy for CT-guided procedures. That said, this was performed in a phantom model and pre-and post-procedure set-up time(s) care may not have been accounted.

Documentation, Outcomes & Governance

Anibal et al.⁵ proposed IR-specific standards for evaluating AI methods and introduced a structured assessment tool for the end user. The assessment spans the entire pathway from the “code-to-clinic”.

Operationalized AI in Surgical Fields

Surgical specialties offer a useful model for interventional radiology because they have begun applying AI across the full procedural care pathway, not merely for image interpretation.

AI and machine-learning tools have been used in surgery for preoperative risk prediction, patient selection, operative planning, case-duration estimation, operating-room management, intraoperative scene recognition, robotic assistance, surgical video analysis, performance assessment, and postoperative complication prediction.

These applications are highly transferable to IR. Surgical AI examples such as critical-view-of-safety recognition during laparoscopic cholecystectomy, video-based technical assessment, and OR scheduling optimization parallel IR needs.

Transferable Leadership Lessons

Ownership

IR physicians must proactively shape AI implementation rather than passively receive externally developed tools. Physicians and administration should validate tools in IR-specific workflows together to ensure AI serves realistic and practical procedural quality, patient outcomes, and specialty-level goals.

Cultural Adoption

Leaders are to frame AI as a tool for assisting physician judgment (much like a MELD score), improving workflow, and advancing patient care—not as a replacement for clinical expertise. Successful adoption depends on early physician engagement, transparent communication about limitations, visible governance, practical training, and alignment with real problems faced by IR teams.

Performance oversight

Physicians and administration are to continuously monitor safety, accuracy, bias, workflow impact and patient outcomes before, during and after deployment of AI tools. Utilize established clear oversight for AI selection, validation, implementation and monitoring.

References

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AI Use

During the preparation of this work, the author used ChatGPT-5.5 Thinking in order to assist condensing and organizing text. After using this tool, the author reviewed and edited the content as needed and takes full responsibility for the content of this work.

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