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Artificial Intelligence Surgery

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Artificial intelligence in hernia surgery: an emerging revolution

Toby Collins[1], **Jacques Marescaux**[2]

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SUMMARY OF SPECIAL ISSUE

We are pleased to introduce the first *Artificial Intelligence Surgery* Special Issue of 2026, a year that promises continued advances in artificial intelligence and its integration into surgical practice.

Artificial intelligence (AI) is beginning to transform every stage of surgical care, and few surgical specialties are better positioned to benefit than abdominal wall surgery. High procedural volume, standardized operative workflows, and the routine availability of laparoscopic and robotic video footage create unique opportunities for developing clinically meaningful AI systems. Recent advances in foundation models, multimodal learning, and large-scale surgical video analysis have accelerated the translation of AI from proof-of-concept research into technologies suitable for clinical deployment.

This Special Issue, guest edited by Prof. Jacques Marescaux and Dr. Toby Collins of IRCAD, Strasbourg, brings together six original research and review articles spanning the surgical pathway - from preoperative planning and intraoperative guidance to postoperative surveillance, surgical education, and quality assurance.

The contributions in this Special Issue span three complementary themes. First, several articles examine AI for clinical decision support, patient-specific prediction, and perioperative planning in abdominal wall surgery, including preoperative planning, risk stratification, outcome and complication prediction, and applications in abdominal wall reconstruction[1-4]. Second, they explore AI for computer-assisted surgery and operative workflow, encompassing AI-assisted imaging, image-guided intervention, surgical workflow analysis, real-time phase recognition, anatomical and instrument recognition, and surgical performance assessment[2-5]. Third, they address the responsible and trustworthy translation of AI into clinical practice, including the use of large language models (LLMs) for adverse-event surveillance using mesh implant narratives, as well as model interpretability, prediction uncertainty, data quality, and broader considerations for reliable and scalable clinical deployment[2-4,6].

[1]Surgical Data Science, IRCAD France, Strasbourg 67000, France.
[2]IRCAD France, Strasbourg 67000, France.

Correspondence to: Dr. Toby Collins, Surgical Data Science, IRCAD France, Strasbourg 67000, France. E-mail: toby.collins@ircad.fr

Collectively, these contributions suggest that the future of AI in abdominal wall surgery lies not in isolated algorithms but in the integration of complementary technologies into a continuous cycle of prediction, guidance, measurement, and learning. Taken together, three overarching messages emerge.

ABDOMINAL WALL SURGERY IS WELL SUITED TO SURGICAL AI

Abdominal wall surgery possesses several characteristics that make it particularly well suited to AI. Its high procedural volumes provide the scale of data needed to develop and validate robust models, while laparoscopic and robotic procedures routinely generate rich visual data capturing anatomy, tissue planes, instruments, and mesh placement. Much of the information required for operative assessment is already contained within the standard laparoscopic or robotic video stream, making hernia surgery particularly well suited to video-based AI without the need for additional imaging or sensing technologies.

Clinical decision-making in abdominal wall surgery also presents an important opportunity for AI. The specialty encompasses a diverse range of patients, defect characteristics, operative techniques, and reconstructive strategies, with considerable variation in practice and no universally accepted treatment pathway for many complex cases. This clinical complexity creates a compelling case for AI-assisted decision support systems capable of integrating multiple sources of information to support more consistent, evidence-based, and personalized treatment planning.

These characteristics also make the field an ideal setting for AI-driven surgical education, where objective analysis of operative video can support technical performance evaluation and personalized feedback.

INTEGRATED AI ECOSYSTEMS WILL DELIVER THE GREATEST CLINICAL VALUE

Rather than highlighting isolated AI applications, the greatest clinical value will come from combining complementary AI technologies across the surgical pathway. Imaging, operative video, clinical records, patient-reported outcomes, and unstructured clinical narratives each contribute unique information to a unified decision-support framework. Together, these diverse data streams can support risk prediction before surgery, guidance during procedures, objective assessment of technical performance, and longitudinal evaluation.

A recurring theme throughout this Special Issue is the emergence of surgical analytics, in which AI enables objective measurement of workflow, technical performance, and outcomes to support standardized assessment, quality assurance, and continuous learning. Rather than functioning as standalone tools, these technologies are beginning to form integrated ecosystems that learn from every stage of patient care.

BUILDING TRUSTWORTHY AI FOR CLINICAL PRACTICE IS THE MAIN BARRIER

The contributions also provide a realistic perspective on the work that remains before AI can be routinely integrated into clinical practice. Common priorities include the development of larger and more diverse datasets, multicentre validation, explainable models, seamless workflow integration, and effective communication of predictive uncertainty. As foundation models and retrieval-augmented generation become increasingly embedded within clinical workflows, transparency, traceability, and rigorous evaluation will become equally important. The goal is not to achieve perfect prediction, but develop trustworthy decision-support systems that augment clinical judgment.

Ultimately, successful adoption of AI in surgery will depend on more than technological progress. It will require cultural, educational, and ethical change, with surgeons equipped to interpret AI outputs critically and apply them appropriately within the broader clinical context. AI systems must not only generate recommendations but also communicate their confidence, underlying rationale, and limitations.

The future of AI in abdominal wall surgery will depend on interdisciplinary collaboration among surgeons, engineers, computer scientists, clinical researchers, regulators, surgical societies, and patients. If developed collaboratively, evaluated rigorously, and implemented responsibly, these systems have the potential to revolutionize decision-making, enhance technical performance, improve the consistency of outcomes, and expand access to care. Their widespread adoption, however, will require demonstrating meaningful clinical benefit through carefully designed prospective clinical validation - a key priority for the coming years.

DECLARATIONS

Authors' contributions

Conceptualization, writing - original draft, review and editing: Collins T, Marescaux J

Availability of data and materials

Not applicable.

AI and AI-assisted tools statement

During the preparation of this manuscript, the AI tool ChatGPT Plus (version GPT-5.3, released 2026-03-03) was used solely for language editing. The tool did not influence the study design, data collection, analysis, interpretation, or the scientific content of the work. Both authors take full responsibility for the accuracy, integrity, and final content of the manuscript.

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Conflicts of interest

Marescaux J is an Honorary Regional Editor of the journal *Artificial Intelligence Surgery*. Collins T is a Junior Editorial Board Member of the journal *Artificial Intelligence Surgery*. Marescaux J and Collins T are Guest Editors of the Topic titled "The Role of Artificial Intelligence in Abdominal Wall Surgery" of the journal *Artificial Intelligence Surgery*. Collins T and Marescaux J were not involved in any stage of the editorial process, including reviewer selection, manuscript handling, or decision-making.

Ethical approval and consent to participate

Not applicable.

Consent for publication

Not applicable.

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