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Invited Commentary

The Emperor's new clothes

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Within the rapidly evolving sphere of surgical innovation, the widespread adoption of robotic surgery demands a critical reexamination. The role of robotic surgery in minimally invasive abdominal operations remains unclear as demonstrated by Cooper et al. in a decade-long retrospective study of open and minimally invasive rectal cancer resections in the community setting [1]. The authors demonstrated both surgical approaches had similar oncologic outcomes, but minimally invasive techniques had superior operative outcomes (i.e., estimated blood loss, blood transfusions, and time to first bowel movements) compared to open surgery. However, they were unable to demonstrate the superiority of robotic surgery over laparoscopic surgery.

In the years following the first robotic colectomy in 2002, persuasive evidence proving the superiority of robotic surgery in rectal surgery has remained elusive. The benefits of robotic surgery over open surgery, as demonstrated in the current study, are well documented. However, the comparison to laparoscopic surgery requires a more nuanced approach. A study focusing on high-risk patients shows that robotic surgery offered certain advantages – notably, higher sphincter preservation rates and reduced operative times – but did not demonstrate a significant superiority over laparoscopic surgery in key outcome measures like reoperation rates, anastomotic leak rates, and 30-day mortality [2]. Moreover, systematic reviews encompassing a breadth of abdominal operations have consistently failed to establish a marked superiority of robotic surgery over conventional laparoscopic surgery in key outcome measures, including complication rates, recovery times, and long-term patient benefits [3]. Moreover, unlike the current study, most studies show robotic surgery incurs significantly higher costs than both open and laparoscopic surgeries when accounting for the costs of buying, operating, and maintaining the surgical robot. This leads to increase cost per operation, with an average simple robotic procedure costing about $7280, compared to $6041 for laparoscopic and $5554 for open surgeries [4]. The current widespread use of robotic surgery despite the additional cost and the absence of evidence of superior outcomes for most use cases evokes a critical question: Why should we continue doing robotic surgery?

The advantage of laparoscopic surgery over open surgery was an attenuated physiological response resulting in less inflammation, less pain, and a more rapid recovery. These were largely the result of the mode of abdominal access (i.e., ports). No additional physiologic benefit should be expected from a robotic approach. Moreover, robotic surgery is an incremental, surgeon-focused evolution of minimally invasive surgery. The claimed advantages of this technology include stereoscopic vision, articulated instruments, scaled movement, and better ergonomics. However, are these significant improvements? First, the advantages of stereoscopic vision and articulated instruments are unclear, both have been available for laparoscopic surgery, but neither technology has been commonly adopted suggesting limited utility. Second, the ergonomics are not necessarily better, a seated relatively immobile robotic surgeon is likely to have a different set of repetitive stress injuries compared to laparoscopic surgeons. This contention will take time to confirm. Finally, the main limitation of both laparoscopic and robotic surgery is the surgeon operating the instruments. Individual differences in surgical judgment and technical abilities may be sufficient to obscure any potential outcome differences between laparoscopic and robotic modalities.

Ultimately, the robotic surgery as currently conceived is a transitional technology. Inevitably, artificial intelligence (AI) will replace the surgeon allowing consistent, optimal outcomes. This revolution, exemplified by the STAR system [5], suggests a future dominated by autonomous AI-operated surgical robotics. However, as explored by Jamjoom et al., this transformation creates critical challenges, including liability in autonomous systems [6]. The public's understanding of accountability and liability unveils a multifaceted ethical and legal landscape as we transition to autonomous robotic surgery. Such complexity should temper our excitement and encourage a deeper, more critical debate regarding our role in this technological revolution. In this era, as clinical medicine moves away from bedside diagnosis to imaging- and laboratory-based diagnosis, we must begin to confront the dilemma of the surgeon's role in patient care as we eventually move away from the console.

Undoubtedly robotic surgery marks a significant evolution in surgical practice, yet its indiscriminate integration—particularly in the absence of evidence demonstrating superiority to conventional techniques—warrants thoughtful reassessment of our use of costly robotic

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platforms. As we navigate the confluence of technological advancement and medical ethics, we must strike a delicate balance between embracing innovation and adhering to evidence-based medicine. Our quest for technological advancement must remain anchored to the primary goal of healthcare: providing accessible, efficacious, and cost-effective treatment for all. In sobering acknowledgment of the reality of surgical robotics, we must recognize that it is less about the surgeon's hands than we might think—we are, in a sense, training our successors.

Ethical approval

This manuscript does not involve human or animal research, and is considered exempt by our local Institutional Review Board.

CRediT authorship contribution statement

Ace St John: Writing – original draft, Writing – review & editing. **Mark D. Kligman:** Writing – original draft, Writing – review & editing.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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