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# The Current Robotic da Vinci System has Limitations for Colorectal Surgical Procedures

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## **Author's contribution**

*This whole work was carried out by author ALAsari.*

**Opinion Article**

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## **ABSTRACT**

Since the introduction of the robotic da Vinci Surgical System, several advantages have been demonstrated in all surgical specialties, particularly in pelvic surgery. However, the current system still has several limitations; one is technically related. In this article, we give our opinion on this limitation and present our recommendations for improvement of robotic surgery in relation to colorectal surgery.

*Keywords: Colorectal; robotic; da Vinci system; limitations.*

## **1. OUR OPINION**

Compared to conventional open surgery, laparoscopic and robotic surgeries require different skills. While open surgery is technically superior for surgeons, laparoscopic surgery receives high marks from patients based on outcomes (e.g., blood loss, hospital stay, pain control or cosmesis). Robotic surgery is both technically viable for operative manipulation and produces excellent outcomes and patient satisfaction ratings.

Since the introduction of the robotic da Vinci system, several advantages have been universally demonstrated. A robotic system provides high-definition, three-dimensional vision, filters physiologic tremor, offers 360-degree articulation of instruments, stable camera control with better ergonomics for easy and fast suturing [1]. Most colorectal surgeons would

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benefit from such a system, especially when working in the narrow pelvis, with strong traction, 3<sup>rd</sup> arm counter traction and dexterous movements [1]. Many surgical procedures using this system have been performed and subsequently published, establishing safety and feasibility profiles [2]. The technical capability of robotic surgery is its most obvious advantage in comparison to laparoscopy [3].

Several technical disadvantages of this robotic system also need to be considered for future improvement. In the area of colorectal surgery, the system has been used for numerous procedures, either benign such as prolapse or malignant such as hemicolectomy, sigmoidectomy, anterior and low anterior resection and abdominoperineal resection. Colorectal resection needs a wide operating field and broad visualization. In a robotic system, one can maximally visualize only half the abdominal area on the same laterality as the patient-side cart; however, in laparoscopic surgery, one can see the entire abdominal quadrant at any time during the procedure. Another limitation is the patient-side cart, which is very large, making the total colectomy procedure difficult to perform; thus, the da Vinci system is 'currently' not yet useful for total colectomy. These limitations in the current system with respect to the bulky patient-side cart footprint and limited visualization of the abdomen leads to difficulties when operating in the lower and upper abdomen or right and left abdomen simultaneously. Moreover, most of the time, we face a difficulty during docking when moving the cart to the appropriate position beside the patient and this might lead to increased operative time.

Other limitations of robotic surgery should be noted as the rapid development of single-port surgery for limited operating field merits evaluation as well. The current single-port setup developed by Intuitive Surgical, with only 2 arms, makes successful colorectal surgery challenging. In colorectal surgery, a 3<sup>rd</sup> arm is needed for counter traction and the operating field inside the abdomen is large. When other single-port access has been used with four, large robotic arms, external collisions become problematic [4]. Moreover, the large patient-side cart leads to difficulty during docking and potentially increased operative time. Such limitations might not be evident for heart, thyroid or gallbladder surgery with the da Vinci Surgical System; however, each specialty has its own limitation when using this system [5,6].

Some authors consider the loss of tactile sensation as a drawback of this system. In our opinion, loss of tactile sensation is not a major drawback because a 3-D visual feedback could be developed with training to compensate for the loss of tactile sensation. The authors recognize that, during the "learning curve," sutures can be cut off from the needle due to limited experience. Different models of training can be used to adapt the robotic visual feedback. Finally, the Vessel sealer, made by Intuitive Surgical was attempted in our colorectal field where it showed good articulation, nice sealing and cut. However, its jaws are large, making it difficult to use for dissection.

## **2. OUR RECOMMENDATIONS AND CONCLUSION**

Future innovation is needed to overcome the aforementioned limitations in robotic system for colorectal surgery: 1. Visualization improvements via a camera that is capable of capturing images for a wide abdominal field; 2. Development of a smaller cart that can be moved easily and adjusted for easy docking for colorectal procedures; 3. Development of a single-port access that allows colorectal surgeons to work with 3 arms plus a camera without collision concerns and 4. A smaller vessel sealer that permits easy dissection.

## CONSENT

Not applicable.

## ETHICAL APPROVAL

Not applicable.

## COMPETING INTERESTS

Author has declared that no competing interests exist.

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