

The da Vinci Surgical System

Gianna Morrongiello, *Biomedical Engineering, University of Rhode Island*
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Abstract—The da Vinci Surgical System is a promising technology used for minimally invasive procedures. Miniaturized wristed instruments and a high-definition 3D camera can translate surgeon's hand movements into precise micro-movements of the robotic instruments, providing surgeons with enhanced capabilities.

I. INTRODUCTION

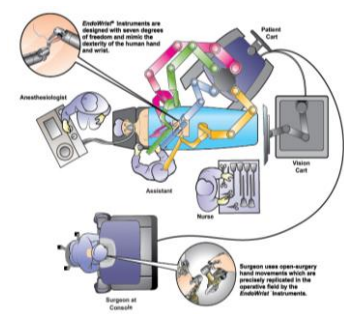
THE da Vinci Surgical System is a robotic operating system that consists of an ergonomically designed surgeon's console, a patient cart with four interactive robotic arms, a high-performance vision system, and patented *EndoWrist* instruments. While this robot plays an important part in these surgeries, the doctors remain 100% in control. As the surgeons view a highly defined and magnified image of the patient's body, the actions that they provide to the controls is mimicked in real-time by the robotic arms to the patient. This system "help[s] your surgeon perform specialized surgical tasks with precision and control" [1] in minimally invasive procedures such as cholecystectomies and splenectomies. Doctors and patients hope that these new technologies will advance in order to decrease tissue trauma and recovery time, and also to provide training for prospective surgeons.

II. METHODS

In this study, 78 female and 50 male patients, with an average age of 52, received varying procedures from 6 different surgeons using the da Vinci robotic surgery system that is resembled by the schematic picture in the figure below. [4]

Because this technology is fairly new, the range of robotic instruments is limited. "A cautery hook, different forceps, scissors, needle holder, clip applicator and an ultrasound coagulation device (*Endosurg*TM) are available. Stapler devices are not yet available" [2]. The procedures that were performed were divided up into 12 main groups: cholecystectomy, partial

fundoplication, colonic intervention, extended thymectomy, splenectomy, bariatric procedures, hernioplasty, oesophageal intervention, adrenalectomy, lower lobectomy, neurinomectomy, and other. All patient participants gave consent to robotic surgery in place of a traditional

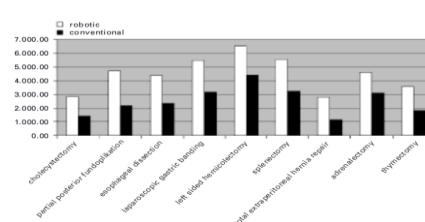


laparoscopic surgery.

III. RESULTS

This study found that while robotic technologies for minimally invasive surgeries seem promising, the cost and time it takes to perform the procedures outweigh the positives. In comparing the traditional laparoscopic non-invasive surgeries to the robotic surgeries, "there was no statistically significant difference in

Procedure	Set-up	Console	Total
Cholecystectomy	35	52	98
Partial fundoplication	35	154	198
Colonic intervention	45	178	310
Extended thymectomy	40	130	150
Splenectomy	35	107	147
Bariatric procedures	45	137	167
Hernioplasty	40	67	118
Oesophageal intervention	40	117	147
Adrenalectomy	40	128	181
Lower lobectomy	70	270	318
Neurinomectomy	30	51	65



much more expensive than traditional surgeries, and took a longer period of time to complete the procedure. The graph and table in the two figures above clearly show this data. [2]

IV. DISCUSSION

In conclusion, strides in advancing robotic surgery technologies are extremely important in the biomedical field. If the time and cost of the procedures with the da Vinci system were reduced, there could potentially be very few flaws in minimally invasive surgery. As these and other technologies advance in the surgical field, "hybrid surgeries" would become more popular. A surgery could take place in the traditional way to keep costs lower, and then for the most challenging parts, where it is more beneficial, robotic surgery could be used. Advances in the da Vinci's image fusion could lead to more precise surgical planning, and doctors could have a clearer view of the patient's body. Lastly, and possibly most importantly, systems like the da Vinci would be able to further train prospective surgeons. By using the controls that power the da Vinci surgical system, training doctors will be able to move onto hands on surgery after successfully completing virtual training. This would increase the success rate of surgeries and decrease human error. Overall, doctors, surgeons, and engineers must continue to make strides in advancing surgical technologies, to provide the safest and most cost effective way to perform procedures.

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