Abstract—The da Vinci® Surgical System is a device that allows doctors to perform minimally invasive operations with ease. This device allows surgeons to view procedures through a console while controlling robotic arms for the incisions. By utilizing the surgeon’s hand motions the device makes extremely precise incisions with real time movement.

I. INTRODUCTION

Robotic systems should especially improve the limited degrees of freedom with classic laparoscopic instruments and the poor ergonomics for the surgeon, which increase fatigue and pose a heavy burden on the surgeon during longer procedures” (Hubens). Laparoscopy is a procedure where a small incision is created and then a thin lit tube is inserted into that same incision (Laparoscopy). It is generally performed when removing organs such as the spleen, prostate, or gallbladder and for checking for internal damage of the body. It is also minimally invasive, less costly than other invasive procedures, and usually doesn’t require a patient’s overnight stay. The precision and difficulty of these operations, however, does put stress on the surgeon. As a result, the da Vinci® was created to relieve the pressure on the surgeons while improving accuracy and efficiency during surgery.

II. METHODS

The da Vinci® consists of four major components. These components are the surgeon console, patient-side cart, EndoWrist instruments, and the vision system (Intuitive Surgical). At the console the surgeon views the patient’s body through a 3D HD display and controls the surgical instruments with electrically synchronized real-time hand and wrist movements. The patient is on the patient-side cart during this procedure. This side cart has fixed pivoting robotic arms working under the surgeon’s commands while holding the endoscopes and the surgical instruments. During the procedure there is also repeated safety checks performed to confirm that the surgeon is still in complete control. To perform various operations the device has a variety of EndoWrist instruments. These are the surgical instruments used by the robotic arms during the operation. They all have levers that allow for quick instrument swapping during surgery. They also allow for greater accuracy because they have more mobility than a human wrist, allowing for seven ranges of motion. The final component, the vision system, has a “high-definition, 3D endoscope (flexible tube with a camera and light at the tip) and image processing equipment that provides true-to-life images of the patient’s anatomy” (The da Vinci Surgical System).

III. RESULTS

In the study conducted by Guy Hubens et al. they chose 6 medical students with no experience performing surgery (1595). They had each one perform four different exercises “using either robotic assistance or classical laparoscopic techniques” (1597). The students were asked to “[place] rings over receptacles, [grasp] a free hanging suture and cut three pieces of it, [run] a suture, and [perform] a surgical knot” (1595). In the results for each trial the da Vinci system allowed the students to accomplish the task successfully and more quickly. The median times for the first four exercises with the da Vinci system were 9.5, 27.5, 60.5, and 51.0 seconds respectively (1560). The manual techniques, on the other hand, required 19.0, 64.0, 356.5, and 184.5 seconds respectively. In addition, the highest median of failures occurred in exercise 3. The da Vinci assisted procedure had a median value of 2 faults at maximum while the traditional technique had a maximum of 38 faults in comparison.

IV. DISCUSSION

Overall the da Vinci® system is a major improvement in laparoscopic technology. This device has shown higher results when compared to traditional laparoscopic techniques. The same side effects associated with the device are the same as a classic laparoscopic procedure. As a result, there is no surgical disadvantage to choosing this device. It also allows more surgeons to perform complex laparoscopic procedures because it is easier to learn (Hubens). Unfortunately, its associated costs place a burden on the device. It costs around 2.2 million dollars not including any additions to the device (Beck). Also the cost per procedure is higher. According to Melinda Beck, “the average total cost to the hospital for a robotic hysterectomy was $8,868, compared to $6,679 for a laparoscopic procedure and $6,651 for an open surgery” (1). Currently the device is available in over 1370 U.S. hospitals but there is controversy as to whether it is the most cost-effective choice. In the future, its technology will hopefully improve and become easily reproducible making it more economical.

REFERENCES