

Robotic Versus Laparoscopic Hysterectomy: A Review of Recent Comparative Studies

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Abstract:

Robotic surgery, computer-assisted surgery and robotically-assisted surgery are terms for technological developments that use robotic systems to aid in surgical procedures. Robotically-assisted surgery was developed to overcome the limitations of pre-existing minimally-invasive surgical procedures and to enhance the capabilities of surgeons performing open surgery. When comparing robotic surgery with laparoscopy or laparotomy in performing hysterectomy and radical hysterectomy, the literature shows that robotic surgery offers an advantage over the other two surgical approaches with regards to operative time, blood loss, and length of hospitalization. Robotic and conventional laparoscopic hysterectomy is essentially equivalent regarding surgical and clinical outcome. Operating time are slightly higher and costs are significantly higher for the robotic procedure.

Keywords: Robotic surgery, Laparoscopic Hysterectomy

Introduction:

Laparoscopic procedures in gynaecologic surgery have been performed successfully for more than 20 years. In 1988 by Reich *et al.*, the first total laparoscopic hysterectomy was carried out¹.

Since then, substantial improvements in optic systems and instrumentation have made laparoscopic surgery much more accurate, safer and probably easier to learn. Owing to these technical advances during the past 20 years, complicated procedures such as gynaecologic cancer surgery, surgery of deep infiltrating endometriosis or prolapse surgery today can be performed safely by laparoscopy and have become standard procedures in numerous centers worldwide.

When comparing robotic surgery with laparoscopy or laparotomy in performing a radical hysterectomy, the literature shows that robotic surgery offers an advantage over the other two surgical approaches with regard to operative time, blood loss and length of hospitalization.

Many studies in the past have demonstrated that laparoscopic hysterectomy leads to lower perioperative morbidity, shorter hospital stay and speedier return to work than abdominal

hysterectomy²⁻⁵. Studies also showed that complication rates are not higher if the operation is performed in experienced centers^{6,7}.

After the introduction of robotic surgery in the field of urology, cardiac and general surgery⁸⁻¹¹, it gained more and more interest in gynaecologic surgery.

Meanwhile, the da Vinci surgical system (Intuitive Surgical Inc., Sunnyvale, California, USA), which until now is the only Food and Drug Administration (FDA) approved robotic device, has been used in gynecological surgery for nearly all gynaecologic procedures such as hysterectomy, myomectomy, radical hysterectomy with pelvic and para-aortic lymphadenectomy, prolapse surgery, tubal anastomosis and endometriosis surgery¹²⁻¹⁶.

More recently, robotic surgery is being used with increasing frequency in gynecologic oncology. Robotic surgery has several advantages over laparoscopy, including improved freedom of movement, three-dimensional vision, elimination of tremor, ability to downscale the surgeons movement, more ergonomic surgeon position and the potential for a shorter learning curve.

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Recently, most comparative studies on robotics in gynecology have been published about oncological procedures such as staging for endometrial cancer or cervical cancer¹⁷. There are only few studies about robotic hysterectomy for benign indications and most of them are retrospective. Even fewer studies exist comparing robotic with laparoscopic hysterectomy. All these studies have sufficiently demonstrated the feasibility and safety of robotic hysterectomy during the past years^{18,19}. However, to date, no randomized controlled trial has been published about this topic.

Literature Review:

There are few more recent studies comparing Robotic with conventional laparoscopic hysterectomy for benign indications^{20,21}. One of the first publications reporting about the outcome of total robotic hysterectomy for benign conditions after the FDA approval for the da Vinci surgical system (Intuitive Surgical Inc.) in 2005 was published in 2006 by Reynolds and Advincula²². In this study, 16 patients with no major complications were reported with no conversions to laparotomy and operative times of 242 min for a median uterine weight of 131g. Several case series about robotic hysterectomy were published in the following years, the most recent of which is by Boggess et al. reported on 152 cases of total robotic hysterectomy with benign indications with no conversions to laparotomy and a median operating

time of 122.9 min²³. In this series big uteri with a median weight of 347g were also included.

To date 44 cases has been reported in the literature of radical hysterectomy performed with Robotic surgery. Although the overall number of cases reported is small, this preliminary information supports the safety and feasibility of the Robotic approach to Radical hysterectomy.

The numerous advantage of robotic surgery have led to increased enthusiasm by surgeons for obtaining equipment and acquiring the skills necessary to successfully perform Robotic surgery. Obviously, when a novel procedure or surgical approach is introduced, one of the most important measures of success is whether the procedure compromises the patient’s oncologic outcome. Although the follow-up time for patients who are undergone robotic radical hysterectomy is short, so far no recurrences were reported. In order to compare these two minimally invasive procedures, we have focused this review on the clinical outcome of both robotic and conventional laparoscopic hysterectomy according to the following points:

- Operation time, Blood loss & Hospital stay
- Conversion & Complications
- Cost.

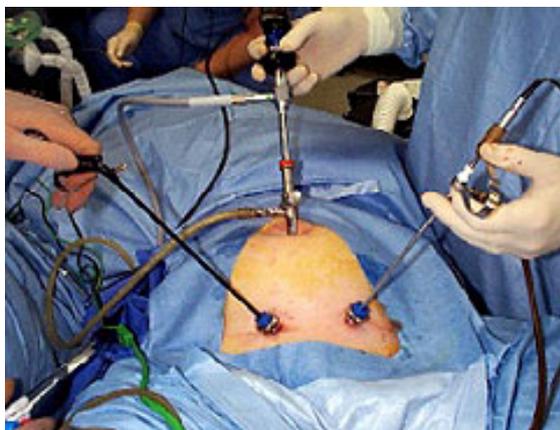


Figure 1: Laparoscopic Surgery.

Operative time, Blood loss & Hospital stay:

In five of the six reviewed comparative studies showed that, operating times were significantly longer in the robotic group compared with the conventional laparoscopic group^{21,22}. Only the study by Giep *et al.* showed no significant difference in operating times. Most recently, authors published a comparative report of series of patients undergoing robotic radical hysterectomy and patients undergoing laparoscopic radical hysterectomy or open abdominal radical



Figure 2: Robotic Surgery.

hysterectomy^{23,25}. The authors found statistically significant differences among the three groups for median [range] operative time 185 minutes [119–281] for robotic surgery, 216 minutes [165–300] for laparoscopy and 157 minutes [122–237] for laparotomy. Estimated blood loss is 100 ml for robotic surgery, 200 ml for laparoscopy, and 350 ml for laparotomy, and median length of hospital stay is 1 day for robotic surgery, two days for laparoscopy, and 3 days for laparotomy (p<0.001).

Conversion & Complication:

In most comparative studies, there was no difference in intraoperative conversion rates between the two groups^{24,25}. The only study that reported a higher rate of conversions for the conventional laparoscopic group was the study by Payne and Dauterive, who reported a conversion rate of 4% and 9%, respectively¹².

Cost:

In the study by Pasic et al. the comparative costs between robot-assisted hysterectomies and conventional laparoscopic hysterectomies were adjusted for type of hysterectomy, complex surgery, co morbidity, hospital site and other variables and cost were calculated for inpatient and outpatient setting¹². In this study, the adjusted costs were 9,640 USD for the robotic group and 6,973 USD for the conventional laparoscopic group. This difference of 2,667 USD was statistically significant ($P < 0.01$).

Current data showed that robotic hysterectomy is a safe and feasible technique and has established itself as a possible alternative to laparoscopic or abdominal hysterectomy. As robotic surgery does not actually seem to give an advantage in surgical and clinical outcome for simple benign hysterectomy, it could be of higher interest for more complicated procedures such as prolapse surgery, myomectomy or cancer surgery.

Conclusion:

For the future, we urgently need randomized controlled trials including cost-effectiveness analysis and quality of life assessment to define the value of robotic surgery. As technical evolution has always influenced surgery in the past, we think that with the input of experienced endoscopic surgeons, robotic surgery with its enormous technical potential could play an important role over the next years and decades.

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