

Hysterectomy for Benign Uterine Pathology: Comparison Between Robotic Assisted Laparoscopy, Classic Laparoscopy and Laparotomy

S. Săceanu^{1,2}, V. Cela^{1*}, V. Surlin², C.M. Angelescu², S. Patrascu², I. Georgescu², A. Genazzani¹

¹Santa Chiara Hospital, Pisa, Italy

²University of Medicine and Pharmacy of Craiova, Romania

Rezumat

Histerectomia în cazul patologiei benigne: studiu comparativ între chirurgia asistată robotic, laparoscopia și metoda clasică

Obiectiv: Histerectomia este una dintre cele mai importante intervenții din ginecologie și cea care impune cea mai mare atenție și pricepere. În acest studiu am încercat să efectuăm o comparație între caracteristicile operatorii ale histerectomiei laparoscopice clasice, histerectomiei asistate robotic și histerectomiei abdominale în tratamentul patologiei uterine benigne.

Material și metodă: Am efectuat un studiu comparativ între 29 paciente ce au fost tratate prin histerectomie laparoscopică asistată robotic în cadrul Spitalului Cisanello, Pisa, Italia, 30 paciente ce au fost tratate prin laparoscopie clasică și 30 paciente ce au fost tratate prin histerectomie laparotomică în cadrul Clinicii 1 Chirurgie Generală, Craiova.

Rezultate: Comparând durata intervențiilor chirurgicale am observat că durata unei intervenții asistate robotic este cea mai mare, 183,9 minute. Chiar dacă durata a fost mai mare, timpul necesar efectuării suturii vaginale a fost mai mic, de 17,75 minute față de 22,79 minute laparoscopic clasic. Din punct de vedere al pierderii sanguine am concluzionat că pierderea de sânge intraoperator a fost cea mai mică în timpul unei intervenții robotice, 199,3 ml versus 285 ml în timpul unei laparoscopii și 417 ml în timpul unei intervenții clasice.

Concluzii: Histerectomia laparoscopică asistată robotic este o metodă fezabilă de tratament care poate fi folosită cu foarte mare succes în tratamentul pacientelor diagnosticate cu patologie uterină benignă.

Cuvine cheie: robot, uter, histerectomie, Da Vinci, laparoscopie

Abstract

Objective: Hysterectomy is one of the most important surgeries in gynecology and requires a lot of care and skill. In this study we attempt to make a comparison between laparoscopic hysterectomy, robotic assisted hysterectomy and abdominal hysterectomy for treatment of uterine pathology.

Materials and methods: We conducted a study comparing 29 patients who were treated by robotic assisted laparoscopic hysterectomy in Cisanello Hospital, Pisa, Italy, 30 patients who were treated by laparoscopy in General Surgery Clinic, Craiova and 30 patients who were treated by abdominal hysterectomy in General Surgery Clinic, Craiova.

Results: Comparing the surgeries, it was noticed that the operative time of a robotic assisted interventions is the largest, 183.9 minutes. Even if the duration was greater, the time needed to perform vaginal suture was lower, 17.75 minutes to 22.79 minutes by classic laparoscopic approach. In terms of blood loss we concluded that intraoperative blood loss was lowest during a robotic surgery, 199.3 ml versus 285 ml in the laparoscopic group and 417 ml in the laparotomic group.

Conclusions: Robotic assisted laparoscopic hysterectomy is a feasible method that can be used very successfully to treat patients diagnosed with benign uterine pathology

Corresponding author:

Sidonia Săceanu, MD
University of Medicine and Pharmacy of
Craiova, Romania
Email: ssidoniam@yahoo.com

*First two authors contributed equally to the manuscript

Key words: robot, hysterectomy, uterus, Da Vinci, laparoscopy

Introduction

Although hysterectomy is one of the most common surgical procedures performed in gynaecology, it implies a great attention from the surgeon, due to the high vascularisation of the pelvis, which implies a meticulous haemostasis. (1)

Pelvic surgery is performed in a very tight area, with a continuous need of visualising the organs, especially for manoeuvres like sectioning, ligation and suture. (2,3)

The Consensus on the current status of robotic pelvic surgery, formulated during the first Pelvic Surgery Meeting held in Brescia in 2007 was published in 2009 in *Surgical Endoscopy*. This consensus highlights the theoretical benefits of robotic hysterectomy (4).

Robotic approach in pelvic pathology offers a tridimensional image that results in increased precision and dexterity. The safety of the procedure increases and the surgeon's fatigue significantly decreases in robotic surgery. (5)

Robotic assisted surgery removes the difficulties resulted from the tight operative space and allows complex surgeries to be performed, without increasing the operative time. (1) Furthermore, compared with classic laparoscopy, robotic surgery confers also the possibility for a less experienced surgeon to perform more complex procedures. (6)

Several techniques for hysterectomy are currently in use in gynaecological practice: total abdominal hysterectomy, total vaginal hysterectomy, total laparoscopic hysterectomy, and total robotic assisted laparoscopic hysterectomy. Total vaginal hysterectomy is the preferred method by the majority of surgeons due to reduced costs, recovery time and complications. (7,8)

The essential steps of the hysterectomy are securing the uterine artery and cardinal ligaments, vagina sectioning and adequate colpotomy. These steps are very easily accomplished by using a robotic assisted laparoscopic approach. (2,9,10)

The aim of this study was the comparative analysis of robotic, laparoscopic and abdominal hysterectomy in order to identify the most effective surgical method for patients diagnosed with various benign conditions. We have analysed the operative time, characteristics of the specimens removed during surgery, and the several clinico-biological parameters that can influence the post-operative evolution of the patients.

Material and Methods

We have performed a retrospective on 89 patients diagnosed with various benign uterine conditions, between 2008 and 2010. The patients were treated by hysterectomy at the Obstetrics and Gynecology Department, Cisanello Hospital, Pisa, Italy, and at the General Surgery Department, Clinical Emergency Hospital of Craiova.

We have included three groups of patients: 29 patients

treated by robotic assisted hysterectomy at the Obstetrics and Gynaecology Department, Cisanello Hospital, 30 patients treated by classic laparoscopy and 30 patients with abdominal hysterectomy at the General Surgery Clinic, Clinical Emergency Hospital of Craiova.

The patients were informed about the surgical procedure and consent was given for performing the surgery and for taking part in the research.

All the procedures were performed under general anaesthesia, endotracheal intubation and Foley catheterisation. In the cases treated by robotic hysterectomy, an intrauterine manipulator was used.

The surgeries were performed according to standard protocols and the uterus was removed using the morcellator in robotic laparoscopic and classic laparoscopic surgeries.

Several clinico-pathological parameters were analysed: age, BMI, personal and family history, preoperative and post-operative clinical and laboratory parameters, and complete data regarding the surgical procedure. Operative times (total duration of surgery, duration of hysterectomy and duration of vaginal suture), quantity of blood loss, histopathological findings, evolution and postoperative complications were also analysed. Total operative time was measured from the moment of the abdominal incision to the last suture.

Statistical analysis. The Gaussian distribution was assessed by using Kolmogorov-Smirnov and Shapiro-Wilk tests. If the variables did not follow a Gaussian distribution, non-parametric statistical tests were performed. Two tailed *p* values <0.05 were considered statistically significant. The data were analysed using GraphPad Prism 5 and GraphPad InStat softwares.

Results

Eighty – nine patients, who underwent total hysterectomy were included in this study. The characteristics of the groups of patients are presented in *Table 1*.

As shown in *Table 1*, the age of the patients varied between the abdominal hysterectomy group and the laparoscopic groups; the older patients were in the group treated by abdominal hysterectomy and the youngest by classic laparoscopic hysterectomy.

The three types of procedures were used for similar conditions. The conditions for which hysterectomy was performed are presented in *Table 2*.

Total time of a surgical procedure was 91.55 minutes for abdominal hysterectomy, 111.5 minutes for classic laparoscopic hysterectomy and 183.9 minutes for robotic-assisted hysterectomy ($p < 0.0001$, Kruskal-Wallis test). Time of hysterectomy was 87.34 for robotic-assisted hysterectomy, 78.55 for laparoscopic hysterectomy and 55.15 minutes for abdominal hysterectomy ($p < 0.0001$, Kruskal-Wallis test). Duration of vaginal suture varied considerably between the three groups: 11.64 minutes for the abdominal approaching, 17.75 minutes for the robotic-assisted laparoscopic hysterectomies and 22.79 minutes for classic laparoscopic hysterectomies ($p < 0.0001$, Kruskal-Wallis test).

Table 1. *The three groups of patients included in the study*

	Robotic assisted laparoscopic hysterectomies	Classical laparoscopic hysterectomies	Abdominal hysterectomies	<i>p</i> (Kruskal-Wallis test)
Number of surgeries	29	30	30	
Age	53.19±1.29	45±2.39	60.82±3.81	<0.0001
Menarche	12.53±0.09	12.33±0.14	12.45±0.16	NS
Births	1.77±0.13	1.25±0.39	1.36±0.41	NS
Abortions	3.32±0.41	2.92±1.21	3.09±1.02	NS
BMI (kg/m ²)	29.24±0.42	27.21±0.45	33.95±1.35	<0.0001

Table 2. *Indications for hysterectomy*

	Robotic-assisted laparoscopic hysterectomy	Classical laparoscopic hysterectomy	Abdominal hysterectomy
Adenomyosis	1	-	-
Fibroma	10	8	10
Polyfibromatous uterus	16	10	15
Cervical dysplasia	2	4	3
Endometrial hyperplasia	-	6	1
Uterine prolapse	-	2	1

The removed uterus varied in weight from 146.2 g in laparoscopic hysterectomies, to 282.5 g in robotic-assisted hysterectomies and 310 g in abdominal hysterectomies ($p=0.0002$, Kruskal-Wallis test).

Intra-operative blood loss varied significantly between the three types of surgical techniques: 199.3 ml in robotic-assisted, 285.3 ml in laparoscopic and 417.7 ml in abdominal hysterectomies. Consequently to the intra-operative blood loss, haemoglobin values varied accordingly. Haemoglobin values varied with 0.69 g/dl in the robotic-assisted hysterectomies, 1.28g/dl in laparoscopic hysterectomies and 1.36 g/dl in abdominal hysterectomies.

The time until recovery of bowel transit varied between 22.85 hours for robotic-assisted hysterectomies, 22.75 hours for laparoscopic hysterectomies and 37.55 hours for abdominal hysterectomies.

The parameter that varied in the largest interval was the time of hospitalisation, being lower in robotic-assisted and classic laparoscopic hysterectomies (2.39 days, respectively 3.75 days) compared with abdominal hysterectomies, 8.09 days.

None of the robotic-assisted hysterectomies was converted to laparotomy, whereas in two cases classic laparoscopic hysterectomy was converted to laparotomy. In one of the cases the exposure of the pelvis was deficient due to technical issues of the CO₂ insufflator, and in another case the conversion followed a massive vaginal haemorrhage.

No major post-operative complications were noticed in any group. The robotic-assisted hysterectomies were followed by urinary infection in four cases. In laparoscopic hysterectomies, complications were as follows: 4 cases of urinary infection, one case of pyrexia and one case of vaginal cuff dehiscence. Abdominal hysterectomy was followed by urinary infection in 4 cases, pyrexia in 5 cases and vaginal cuff dehiscence in 1 case.

Discussion

Laparoscopic hysterectomy and robotic-assisted hysterectomy are the newest methods for surgical cure in benign uterine pathology. According to international guidelines, they should not replace vaginal hysterectomy, but should be a valuable alternative for abdominal hysterectomy in cases where vaginal approaching is contraindicated.

In this study we aimed to compare abdominal, classic laparoscopic and robotic-assisted laparoscopic hysterectomy in a three years period (2008-2010). During this interval the number of laparoscopic and abdominal hysterectomies was much higher than the number of robotic-assisted hysterectomies; in order to analyse an approximately equal number of patients in each group, we have randomly selected 30 patients from each of the classic laparoscopic and abdominal hysterectomies. The characteristics of the patients in each of the three groups were mainly similar. We have observed a difference in the patients' age; while patients treated by abdominal hysterectomy were the oldest, patients treated by classic laparoscopic hysterectomy were the youngest. This difference is probably due to the well-known fact that the younger patients prefer innovative methods of treatment that also confer an aesthetic scar.

In our study the operative time was the lowest for abdominal hysterectomy and highest for robotic-assisted hysterectomy. The difference in total operative time came mostly from the time spent for docking and changing instruments. In other studies various similar – 96 minutes (11), higher – 146.5 and 150.5 minutes (5,12) or lower – 67.5 minutes (13) times for abdominal hysterectomy were observed.

Our result for classic laparoscopic hysterectomy times were similar to those observed in other studies, that varied between 111 minutes (14,15) to over double than that: 281.4 minutes (16) or 318 minutes (17).

Table 3. Operative times for the three hysterectomy techniques

	Robotic assisted laparoscopic hysterectomies	Classical laparoscopic hysterectomies	Abdominal hysterectomies	<i>p</i> (Kruskal-Wallis test)
Total operative time (min)	183.9±8.91	111.5±4.78	91.55±6.26	<0.0001
Duration of hysterectomy (min)	87.34±2.78	78.55±7.26	55.15±5.80	<0.0001
Vaginal sutures (min)	17.75±0.97	22.79±0.65	11.64±0.53	<0.0001
Uteri weight (g)	282.5±23.07	146.2±8.19	310±25.00	0.0002
Intra-operative blood loss (ml)	199.3±12.8	285.3±12.56	417.7±16.53	<0.0001
Pre-operative Hb (g/dL)	12.64±0.16	12.55±0.28	11.48±0.33	0.01
Post-operative Hb (g/dL)	11.95±0.15	11.27±0.24	10.13±0.28	0.0001
Hb decrease (g/dL)	0.69±0.04	1.28±0.09	1.36±0.12	<0.0001
Time until recovery of bowel transit (hours)	22.85±2.85	22.75±1.99	37.55±1.74	NS
Hospitalisation	2.39±0.07	3.75±0.43	8.09±0.76	<0.0001

In our study total duration of robotic-assisted hysterectomy was 183.9 minutes, but only 87.34 minutes was the effective hysterectomy. Different authors have reported different operative times from 113 minutes (18) to 378 minutes (17).

We have observed that duration of vaginal suture was close between patients treated by robotic-assisted and abdominal hysterectomies, and were higher in patients treated by laparoscopic hysterectomy. The higher duration for classic laparoscopic sutures can be explained by the rigidity of the instruments used in this type of surgery. The apparently paradoxical similarity between duration of sutures in robotic-assisted and abdominal hysterectomies was very likely to happen since the robotic approach has the advantage of a tridimensional image and of surgical instruments that simulate the human hand.

The uterine weight in our study was the lowest for classic laparoscopic surgery and the highest for abdominal hysterectomy. Uterine weights from 135.53 (19) to 217 (7) grams were reported for robotic-assisted hysterectomies, and from 106 grams (20) to 243.5 grams (13) for abdominal hysterectomies.

As expected, blood loss analysis was lowest in the robotic-assisted approach and the highest in the abdominal hysterectomies group, in which a large volume of blood is lost from the abdominal incision. The difference in volume of blood loss in our study was confirmed by the difference in Hb values, which decreased with less than 1g/dl in robotic-assisted hysterectomies and with over 1g/dl in abdominal hysterectomies. In different studies, generally lower volumes of blood loss are communicated: 41.22 to 74.5 ml for robotic-assisted, 105.23 to 145 ml for laparoscopic and 255.94 to 266 ml for abdominal hysterectomies (5,21).

The most evident difference between the three groups was observed for patient hospitalisation, which in our study varied considerably between patients who had undergone robotic-assisted, laparoscopic and abdominal hysterectomies. All previous studied reported differences in duration of hospitalisation which followed the same pattern as observed in our study (5,20).

Intraoperative and postoperative complications were less frequent in patients who had undergone robotic-assisted

hysterectomies. In patients from the abdominal hysterectomy groups pyrexia was the most frequent complication, while in abdominal and classic laparoscopic hysterectomies, vaginal cuff dehiscence was the most serious complication. Vaginal cuff dehiscence occurs after a deficient suture, consequence of the rigid position of instruments.

In summary, robotic-assisted surgery uses a tridimensional image that result in increased precision and superior dexterity, overcoming the limits of abdominal and classic laparoscopic approaches, without significant increase in operative time.

Acknowledgements

M.S.S. was supported by the POSDRU/88/1.5/S/52826 grant entitled „Development of PhD Schools by offering scholarships to full-time PhD students”. During her PhD she was enrolled for four months in the Santa Chiara Hospital under direct supervision of Professor Andrea Genazzani.

Conflict of interests

The authors declare no conflict of interest.

References

1. Kueck AS, Gossner G, Burke WM, Reynolds RK. Laparoscopic technology for the treatment of endometrial cancer. *Int J Gynaecol Obstet.* 2006;93(2):176-81.
2. Săvulescu F, Iordache I, Albița O, Hristea R, Dumitru C, Iordache A, et al. Giant uterine leiomyoma. *Chirurgia (Bucur).* 2011;106(5):665-8.
3. Sgarbura O. Rolul chirurgiei robotice în tratamentul chirurgiei pelvine. *Media Academică.* 2010.
4. Herron DM, Marohn M. The SAGES-MIRA Robotic Surgery Consensus Group-A consensus document on robotic surgery. *Surg Endoscopy.* 2008;22:313-25.
5. Boggess JF, Gehrig PA, Cantrell L, Shafer A, Ridgway M, Skinner EN, et al. A comparative study of 3 surgical methods for hysterectomy with staging for endometrial cancer: robotic assistance, laparoscopy, laparotomy. *Am J Obstet Gynecol.* 2008; 199(4):360.e1-9.
6. Jayaraman S, Quan D, Al-Ghamdi I, El-Deen F, Schlachta

- CM. Does robotic assistance improve efficiency in performing complex minimally invasive surgical procedures? *Surg Endosc.* 2010;24(3):584-8.
7. Shashoua AR, Gill D, Locher SR. Robotic assisted laparoscopic hysterectomy versus conventional total laparoscopic hysterectomy. *JSLs.* 2009;13(3):364-9.
8. Ursuleanu A, Nicodin O, Gussi I, Niculescu N, Costăchescu G. Results of extension of classic indications of vaginal hysterectomy for benign uterine conditions. *Chirurgia (Bucur).* 2012;107(6):761-6.
9. Pantea S, Duță C, Sargan I, Lazăr F, Papurică M, Bălașa-Guragata C, et al. Laparoscopy-assisted total vaginal hysterectomy with transperitoneal lymphadenectomy for early cervical cancer - surgical technique. *Chirurgia (Bucur).* 2011;106(3):365-8.
10. Oehler MK. Robot-assisted surgery in gynaecology. *Aust N Z J Obstet Gynaecol.* 2009;49(2):124-9.
11. Kuoppala T, Tomás E, Heinonen PK. Clinical outcome and complications of laparoscopic surgery compared with traditional surgery in women with endometrial cancer. *Arch Gynecol Obstet.* 2004;270(1):25-30.
12. Kim DY, Kim MK, Kim JH, Suh DS, Kim YM, Kim YT, et al. Laparoscopic- assisted vaginal hysterectomy versus abdominal hysterectomy in patients with stage I and II endometrial cancer. *Int J Gynecol Cancer.* 2005;15(5):932-7.
13. Feuer G, Benigno B. Comparison of a novel surgical approach for radical hysterectomy: robotic assistance versus open surgery. *J Robotic Surg.* 2009;3:179-86.
14. Drahonovsky J, Haakova L, Otcenasek M, Krofta L, Kucera E, Feyereisl J. A prospective randomized comparison of vaginal hysterectomy, laparoscopically assisted vaginal hysterectomy, and total laparoscopic hysterectomy in women with benign disease. *Eur J Obstet Gynecol Reprod Biol.* 2010;148(2):172-6.
15. Soto E, Lo Y, Friedman K, Soto C, Nezhat F, Chuang L, et al. Total laparoscopic hysterectomy versus da Vinci robotic hysterectomy: is using the robot beneficial? *J Gynecol Oncol.* 2011;22(4):253-9.
16. Nezhat F.R., Datta S. et al. Robotic radical hysterectomy versus total laparoscopic radical hysterectomy with pelvic lymphadenectomy for treatment of early cervical cancer. *JSLs.* 2008. 12:227-237
17. Kilic GS, Moore G, Elbatanony A, Radecki C, Phelps JY, Borahay MA. Comparison of perioperative outcomes of total laparoscopic and robotically assisted hysterectomy for benign pathology during introduction of a robotic program. *Hindawi Publishing Corporation, Obstetrics and gynecology International.* 2011. Article id 683703.
18. Gortchev G, Tomov S. Da Vinci S robotic surgery in the treatment of benign and malignant gynecologic tumors. *Gynecol Surg.* 2010;7:153-7.
19. Sarlos D, Kots L, Stevanovic N, Schaer G. Robotic hysterectomy versus conventional laparoscopic hysterectomy: Outcome and cost analyses of a matched case-control study. *Eur J Obstet Gynecol Reprod Biol.* 2010;150(1):92-6.
20. Cardenas-Goicoechea J, Adams S, Bhat SB, Randall TC. Surgical outcomes of robotic-assisted surgical staging for endometrial cancer are equivalent to traditional laparoscopic staging at a minimally invasive surgical center. *Gynecol Oncol.* 2010;117(2):224-8.
21. Shah NT, Wright KN, Jonsdottir GM, Jorgensen S, Einarsson JI, Muto MG. The feasibility of societal Cost Equivalence between robotic hysterectomy and alternate hysterectomy methods for endometrial cancer. *Hindawi Publishing Corporation. Obstet Gynecol Int.* 2011;2011:570464.