

# *Journal of Robotic Surgery*

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## **Supplement Issue on Robotic Gynecological Surgery**

*Selected Abstracts Presented at the 4th Annual SERGS Meeting on Robotic Gynecological Surgery in conjunction with the 3rd French Annual Meeting of the French Speaking Group in Robotic Gynecological Surgery, June 13–15, 2012, Marseille, France*

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### **Guest Editors**

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## Preface

The Society of European Robotic Gynecological Surgery (SERGS) was established in June 2008 by 20 European gynecologic surgeons who met in the enchanting village of Bellagio (Villa Serbelloni), on Lake Como, Italy. The founding members who attended the meeting were: A. Maggioni (Chair), L. Bocciolone, M. Caillet, N. Colombo, N. Fattizzi, C. Köhler, E. Lambaude, F. Narducci, J. Persson, G. Schär, B. Sert, J. Shepherd, I. Vergote, D. Vitobello, V. Zanagnolo, T. Bonciani, F. van Hyfte, A. Verlinden, L. van Ruyssevelt, and K. Rogerson. The SERGS ([www.sergs.org](http://www.sergs.org)) was founded with the aim to better coordinate the activities of those European institutions where robotic surgery is performed. The Society is directed towards young surgeons who are open to technological innovations as well as the more senior attending surgeons who work in institutions where robotic-assisted laparoscopic surgery is performed on a regular basis. Most recently, the *4th Annual SERGS Meeting on Robotic Gynecological Surgery* in conjunction with the *3rd French Annual Meeting of the French Speaking Group in Robotic Gynecological Surgery* was held during June 13–15, 2012, in Marseille, France, chaired by Drs. Eric Lambaudie and Fabrice Narducci.

The aim of the 4th Annual SERGS Meeting was to enhance the inherent dynamism in the field of robotic surgery among European gynecologists and gynecologic oncologists. While a majority of participants were from European countries, a substantial number of participants were from other nations and continents. The conference was attended by 400 participants from over 25 countries covering the latest research and clinical aspects of robotic surgery in gynecology. Over 75 abstracts and videos were selected for oral and poster presentations. This special/supplement issue of the *Journal of Robotic Surgery* covers the selected abstracts from presentations by the invited faculty, and delegates who gave oral communications and/or poster presentations. Among other highlights of the meeting, the organizing committee (in cooperation with European and other international experts) organized committees that described through their invited lectures, parameters for standardization of da Vinci<sup>®</sup> procedures in benign and oncologic surgeries. Also, in collaboration with ESGO (European Society of Gynecological Oncology), an optional pre-course was offered for young surgeons on the basics of robotic surgery.

We believe that these selected abstracts from the SERGS invited faculty and course participants provides a contemporary view of recent advances in the state-of-the-art surgical techniques in gynecology.

*Robert W. Holloway, M.D.*  
*Sarfraz Ahmad, Ph.D.*

**Guest Editors**

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**SERGS-2012 Organizers**

**The Guest Editors Dr Sarfraz Ahmad and Dr Robert Holloway declare they have no direct conflicts-of-interest related to the abstracts in this supplement; Dr Holloway is a training consultant for Intuitive Surgical, Inc.**

## I. Invited Lectures

### 1 ENYGO: Training in gynecological oncology

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The European Network of Young Gynae-Oncologists (ENYGO) was created in 2009 as a network for juniors and trainees in Gynaecological Oncology and related sub-specialties, within the European Society of Gynaecological Oncology (ESGO). ENYGO is the principal European network, representing the needs and aspirations of all trainees involved in the study, prevention and treatment of gynaecological cancer. It is supported in all its activities by ESGO. It serves as a forum for promoting scientific and social interaction, discussion, debate, exchange of ideas and views amongst trainees. ENYGO currently has approximately 400 members from 40 countries across Europe with each country having a national representative. ENYGO is represented on the ESGO council, and more information about ENYGO is available on [www.enygo.org](http://www.enygo.org).

Over the last few years, ENYGO has undertaken a number of initiatives, including organizing young doctor sessions at ESGO conferences (Serbia and Milan), social activities, hospital visits and workshops. A successful Teaching the Teachers (TTT) Workshop was organized in Amsterdam, in May 2011. The importance of training teaching according to modern concepts and mechanisms such as CANMEDS and SMART rules were highlighted. This facilitates the phenomenon of 'life long learning.' The next TTT workshops will be held in Macedonia in June 2012 and Berlin in November 2012.

An internet survey undertaken by the ENYGO EEG to which 190 members responded. This showed that surgical anatomy and laparoscopic surgery in gynaecological oncology were the topics most members felt they would like to see covered by workshops. Based on these results the ENYGO EEG is facilitating the organization of a combined 2-day workshop focusing on surgical anatomy and laparoscopic surgery in London in September 2012. ENYGO is also helping facilitate and organize a young gynae-oncologist session (YDS, Young Doctors' Session) at the upcoming IGCS conference in Vancouver in October 2012.

A recent web-based ENYGO survey of European fellows in gynaecological oncology highlighted the importance of accredited training. The questionnaire included socio-demographic information, details regarding training posts and a 22 item questionnaire (1–5 Likert scale) evaluating training experience in gynaecological oncology. Two clusters identified in the cohort ( $CH = 47.35$ ) differed mainly by the presence of accredited training ( $p = 0.003$ ). Compared to other trainees, trainees in accredited programmes fared significantly better in 17 of 22 aspects of gynaecological oncology training. The training satisfaction score (TSS) was higher for training in accredited posts ( $p < 0.0005$ ) and independent of age ( $p = 0.360$ ), working-hours ( $p = 0.620$ ), overtime-pay ( $p = 0.318$ ), annual leave ( $p = 0.933$ ), gender ( $p = 0.545$ ) and marital status ( $p = 0.731$ ). The data demonstrate the importance of accredited training in gynaecological oncology and the urgent need for harmonization of gynaecological oncology training within Europe. ENYGO is delighted for the opportunity to work with SERGS and CRG on robotic training for fellows in gynaecological oncology. Results from a web-based survey on the perception of trainees regarding status of robotic training in gynaecological oncology will be presented at the meeting.

### 2 Integration and implementing robotic surgery in the OR: what is required?

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**Background:** Integrating and implementing robotic surgery in the operating room (OR) is a complex thing. The robot system first of all requires good space but factors such as right power supply, right placement of sockets, monitors and other equipment are just as essential. For example, the entrance doors to the OR must be high and wide enough for the different components; the elevator must manage the weight of the system.

Implementing robotic surgery is not only a matter of the physical environment in the OR suite, there are also issues of the human factor and nature that must be considered; otherwise the incorporation of robotic surgery into practice can be difficult. Robotics is a radical culture change with new roles for the OR team where nurses and doctors feel that they have increased responsibility both for the patient and the robot [1].

The most important thing when starting, is the team building and to choose motivated and dedicated team members. Well-trained OR staff are as important as the equipment and instruments needed, therefore proper training for doctors and nurses together is a necessity and must be done in a structured way. Communication, troubleshooting and emergency procedures are essential in the training program to enhance the patient safety [2].

The team also consists of a "surrounding team", such as the Central Sterilization Department and the Medical Technical Department. They must be involved from the beginning to achieve good collaboration.

Protocols, guidelines and checklists should be made up, the working schedule for the OR staff must be adjusted to suit the robotics program. Creating a position for a robotic coordinator/robotics nurse specialist can be beneficial for the robotic program at the hospital [3].

**Focus of interest:** This presentation will focus on things needed to make the implementation and integration of robotics easy, such as team work, training and the physical environment in the OR.

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### 3 Standardized simple hysterectomy: Educational working model

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Since 2000 and the arrival of robotic assistance in our surgical practices, the interest of this technology has been demonstrated in various indications. The success of this new technology (da Vinci System<sup>®</sup>, Intuitive Surgical, Inc.) is interesting: because finally this minimally invasive approach is laparoscopic. And conventional laparoscopy exists since almost 30 years and has been particularly developed in Europe; with the same advantages than robotic assistance compared to open (laparotomy), in endometrial and cervical cancers: small scars, less blood loss, shorter hospital stay, less morbidity, better quality-of-life and same oncological results. But despite randomized trials showing these advantages compared to open, to date, conventional laparoscopy for hysterectomy in oncological indications is used in only in 25 % of cases in our country.

The main issue which may explain the lack in the diffusion of conventional laparoscopy is its long and difficult learning curve: because innate ability for laparoscopy is different between two surgeons and the learning curve of right hand is different than the left hand. Robotic assistance should compensate these missing innate skills: it has been observed a learning curve improvement related to 3D vision and it has been demonstrated that robotic assistance offers the possibility to work without difference with both hands.

In addition, standardization of the procedure is certainly the ultimate advantage of robotic assistance to shorten surgeon's learning curve. We established at our institution a standardization program for our residents, using the example of simple hysterectomy. Positioning of the patient and port's placement are standardized as the surgical procedure which is divided in 14 steps as shown in the videos. At each step, an objective, the role of different instrument, and the role of the assistant are defined. Using this systematic approach, the procedure is easy to teach, easy to learn and the OR time should be shorter due to a faster learning curve.

#### 4 Ins and outs of anaesthesia parameters in robotic surgery: Which ventilation strategy in obese patients?

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Robotic-assisted laparoscopy has an exponential growth and obesity prevalence is around 14.5 % in France. General anaesthesia with endotracheal intubation and mechanical ventilation are the safest strategies. The pneumoperitoneum and the patient positions required for laparoscopy induce pathophysiologic respiratory changes particularly with high intra-abdominal pressure (IAP) of dioxide carbon.

The decrease of pulmonary functional residual capacity and increase in peak airway pressure is proportional to the increase of weight, IAP and patient positioning. The head-down positions facilitates the development of atelectasis much more than in normal weight patients and such compression atelectasis has a known negative effect on gas exchange (ventilation/perfusion mismatch) and lungs mechanics. During pneumoperitoneum, mechanical ventilation must be adjusted to maintain PetCO<sub>2</sub> at approximately 35 mmHg. Various intra-operative strategies are possible and the choice between volume controlled ventilation or pressure controlled ventilation is always discussed. High per operative FiO<sub>2</sub> ≥ 50 % could increase lung collapse. The increase in PaCO<sub>2</sub> depends on IAP. The controlled mechanical compensatory hyperventilation is sufficient to reduce hypercapnia, except when CO<sub>2</sub> subcutaneous emphysema develops. Increase of respiratory rate rather than of tidal volume may be preferable in patients with COPD or with history of bullous emphysema

to avoid increased alveolar inflation. Anaesthesiologists frequently set inappropriately high tidal volumes particularly in obese patients and tidal volumes less than 10 ml/kg set according to predicted body weight (PBW) rather than actual body weight should be the standard. Lung alveolar recruitment manoeuvres and adequate positive end-expiratory pressure (PEEP) must be used to reverse lung collapse. Clinical recommendations can be formulated to perform per-operative ventilation. Mean airway pressures, pulmonary compliance, IAP, adequate muscle paralysis, Pet CO<sub>2</sub> and SpO<sub>2</sub> can reliably reflect PaCO<sub>2</sub> and must be monitored in routine. IAP must also be monitored and kept as low as possible to reduce respiratory and hemodynamic changes. Intra-operative considerations must be addressed by anaesthesiologist for adaptation and communicated to surgeon. Lung recruitment maneuvers and lung protective approaches are ventilator strategies which were developed to reverse anaesthesia-induced lung collapse. Team working is essential much more with obese patients to adjust our practice in order to make safer this innovative surgical process.

## II. Oral Communications

### 1 Virtual reality training for robotic surgery: Validation of a new simulator

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**Objectives:** With the increase in robotic surgery, there is a concomitant rising demand for training methods. Virtual reality simulation seems to be a promising tool to train this type of surgery. Our objective was to establish face- and construct validity of a novel virtual reality simulator (dV-Trainer<sup>™</sup>, Mimic Technologies, Seattle, WA) for the use in training of robot-assisted surgery with the daVinci<sup>®</sup> Surgical System.

**Methods:** Participants of the 2nd European Symposium on Robotic Gynaecologic Surgery (n = 42) were divided in three groups according to their experience in robotic surgery: 'Novices' (n = 15): no robotic experience, 'Intermediates' (n = 14): 5–50 cases performed and 'Experts' (n = 13): more than 70 cases performed. To determine construct validity, all participants performed three different exercises (level two) on the simulator twice. Multiple performance parameters were measured. To determine face validity, participants filled in a questionnaire after completion of the exercises.

**Results:** Experts outperformed novices in most of the measured parameters. The most discriminative parameters were 'time to complete' and 'economy of motion' (p < 0.001). Experts outperformed intermediates in these parameters in two of the three exercises (p < 0.05). The training capacity of the simulator was rated 4.6 ± 0.5 (SD) on a 5-point Likert-scale. The realism of the simulator in general, visual graphics, movements of instruments, interaction with objects and the depth perception were all rated as being realistic.

**Conclusions:** Face- and construct validity for the simulator could be established for several parameters. The virtual reality simulator is a promising and useful tool for training robotic surgery.

## 2 ViKY uterine positioner in gynecological robotic surgery

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**Aim:** A pilot study of uterine manipulation with a new surgical robot for gynaecological surgery.

**Methods:** A prospective cohort study of the ViKY Uterine Positioner in combination with the V-Care manipulator. Data was recorded relating to set up, operating time, usability and complications.

**Results:** Thirty-six cases were performed between July 2010 and February 2012 including 31 hysterectomies, two myomectomies, two sacrocolpopexies and one severe endometriosis. Mean was age 48 year, BMI 25.7 kg/m<sup>2</sup>, uterine weight 231 g. Nine cases were foot controlled and 27 by Bluetooth voice control. Mean procedure (skin-to-skin) duration was 142 min whilst mean ViKY docking time once V-Care inserted, was 4.3 min. No peri-operative complications were observed. Adequate mobilization, visualization and range of movements were possible in 81, 78 and 61 % of cases, respectively, with most of the problems arising in cases with uterine weight >350 g. ViKY positioner was detached and an assistant was required in three cases, whilst V-Care came out of the uterus in one case. The learning curve led to various adjustments including optimizing patient position, increasing the device range of movement and adjusting device sensitivity. As a result problems were minimized in our last nine cases.

**Conclusions:** Adding robotic uterine manipulation is the obvious next step to give the gynecologist the ultimate control and stability of the uterus during MIS without having to lift their head from the viewfinder. ViKY Uterine Positioner is the first device to deliver this. Pilot study results show it to be very safe, effective and easy to learn.

## 3 Long-term outcomes after totally robotic sacrocolpopexy for treatment of pelvic organ prolapse

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**Purpose:** This study evaluates the feasibility, the safety, the effectiveness and the long-term results of pelvic organ prolapse surgery using the da Vinci<sup>®</sup> robotic system.

**Methods:** During a 7-year period, 52 consecutive patients with pelvic organ prolapse underwent robotic-assisted abdominal sacrocolpopexy. Clinical data were retrospectively collected and analyzed.

**Results:** All but two of the procedures were successfully completed robotically (96 %). Median operative time was 190 min (range 75–340). There was no mortality and no specific morbidity due to the robotic approach. Mean hospital stay was 5-days. The median follow-up was 42 months. Five recurrent prolapses (9.6 %) were diagnosed.

**Conclusion:** Our experience indicates that using da Vinci<sup>®</sup> robotic system is feasible, safe and effective for the treatment of pelvic organ prolapse with good long-term results.

## 4 Is BMI a criteria restricting robotic practice in gynecological oncology?

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**Introduction:** Surgical management of obese patients presents several technical challenges in women with gynecological cancers. This is worsened by delayed recovery complicated by infections and thrombo-embolic disease (TED). Robotic surgery (RS) offers the opportunity to overcome these problems.

**Methods:** Prospective observational study in a tertiary gynecological oncology centre with two surgeons over 2-years. Patient demographics, intra- and post-operative data recorded. Body-mass index (BMI) was determined at pre-operative assessment.

**Results:** One-hundred-twenty-two cases performed till date. BMI divided as follows: (normal BMI <24.9 kg/m<sup>2</sup> [20/122]; overweight BMI 25–29.9 kg/m<sup>2</sup> [21/122]; obese BMI 30–34.9 kg/m<sup>2</sup> [39/122] and morbidly obese BMI over 35 kg/m<sup>2</sup> [24/122]) with a maximum BMI of 59 kg/m<sup>2</sup>. Comparing non-obese 41/122 with obese 63/122, operative times and blood loss was comparable. Length of stay was unaffected. No cases of TED were noted in either group. Four of 122 (3.3 %) cases were converted to laparotomy; however, none of these were related to BMI.

**Conclusions:** Surgery in the obese is challenging with higher risks irrespective of the surgical modality. In the GOG LAP2 study, BMI was identified as a major risk factor for conversion to laparotomy with a conversion rate of 34.7 %. At our centre, by default, morbidly obese women were offered open surgery, similar to the exclusion criteria of the LAP2 study. In our series discussed here, 64 % of women would have undergone open surgery prior to advent of the robot. Many women, especially the obese, will benefit from robotic surgery and high BMI is not an exclusion criterion as shown in our series.

## 5 Robotic nerve-sparing versus laparoscopic without nerve-sparing radical hysterectomy in early cervical cancer: Urinary diseases

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**Introduction:** Radical hysterectomy in early cervical cancer less than 2 cm is associated with specific morbidity. Urinary disorders are often noticed and can depend on pelvic plexus nerve injuries. The purpose was to compare surgical and short-term outcomes, as well as urinary disorders between robotic-assisted nerve sparing radical hysterectomy and laparoscopic no nerve-sparing radical hysterectomy.

**Methods:** The first 19 cases of robotically-assisted nerve-sparing type C1 radical hysterectomy for early cervical cancer less than 2 cm were compared with the 28 previous cases of open-laparoscopy type B radical hysterectomy.

**Results:** The two groups were comparable in terms of age, BMI and tumor size. There was no significant difference with median of blood loss. Robotic hysterectomy was associated with a shorter hospital stay median (4 vs. 5 days). The median operating time was longer in the



robotic group (290 vs. 240 min). The nerve-sparing procedure was performed in every robotic-assisted radical hysterectomy and there were no intra-operative complications. Margins were free of disease in all cases. Post-operative urinary retention was more frequent in the laparoscopic group (28.6 vs. 10.5 %), and more patients needed catheterization (13.8 vs. 5.5 %) in the laparoscopic group.

**Conclusions:** Robotic-assisted nerve-sparing radical hysterectomy can be considered as a feasible and safe procedure. Using the robotic system appears to preserve the autonomic nerves, and therefore, can decrease the bladder dysfunction, improving the quality of life of these young patients.

## 6 Robotic-assisted laparoscopy for deep infiltrating endometriosis: International multi-centric retrospective: SEGRS 2012 Endometriosis Group

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**Introduction:** Surgery for deep infiltrating endometriosis (DIE) is associated with a high rate of peri-operative morbidity. The different advantages of the robotic assistance (three-dimension endoscopic vision, tremor filtration, and surgical ergonomics) can improve performances of standard laparoscopy for DIE surgery.

**Methods:** From January 2008 to April 2012, patients with stage IV endometriosis operated with a da Vinci<sup>®</sup> Surgical System were included retrospectively in this study by eight referral centers. The criteria studied were history of the patient, symptoms, initial examination, medical pre- and post-operative treatments, per-surgical assessment, length of intervention, procedures performed, complications, relapse, impact on fertility.

**Results:** One hundred-sixty-seven patients have been included. The procedure was performed with a robot type da Vinci<sup>®</sup> Surgical System. Mean surgical duration was 179 min with an average time at console of 137.6 min. The surgical team carried out: 28 (16.7 %) hysterectomies; 105 resections of uterosacral ligaments (62.5 %, 43 unilateral, 62 bilateral); 62 ureterolysis (36.9 %, 43 unilateral, 19 bilateral); three (1.8 %) ureteral re-implantations, 22 (13.1 %) partial cystectomies; 68 (40.5 %) rectal shavings; 24 (14.3 %) segmental bowel resections; one (0.6 %) temporary stomy. Mean blood loss was 95.5 ml (range 5–2,300). Transfusion was only needed once. Mean length of hospitalisation was 4.02 days (range 1–20). We observed post operative complications for 17/167 (10.2 %) patients: Urinary self catheterization: n = 1 (0.6 %); Uretero-vesical anastomosis linkage: n = 1 (0.6 %); Ureteral fistula after ureterolysis: n = 2 (1.2 %); Pelvic hematoma: n = 1 (0.6 %); Urinary infections: n = 8 (4.2 %); Abdominal wall abscess: n = 1 (0.6 %); Vaginal cuff bleeding: n = 2 (1.2 %); Vaginal cuff disclosure: n = 1 (0.6 %). The rate of re-intervention: n = 3 (1.8 %).

**Conclusions:** To our knowledge, this study is the largest published in the literature. The feasibility of robot-assisted laparoscopy (RAL) for DIE was demonstrated without increasing of surgical timing, blood

loss, intra-operative or post-operative complications. Deep infiltrating endometriosis is probably one of the best indications for RAL in benign gynecologic surgery. Benefits for patients need to be confirmed.

## 7 Clinico-pathological and surgical outcomes analyses of cervical cancer patients treated with robotic-assisted radical hysterectomy

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**Objective:** To report a single institutional learning curve experience for five surgeons performing their first robotic-assisted radical hysterectomies (RARH) for treatment of cervical cancer (CC).

**Methods:** We retrospectively reviewed medical records from all of the initial 81 CC patients who underwent RARH with pelvic lymphadenectomy (4/1/07 to 12/31/11). Records were analyzed for clinico-pathologic data and operative outcomes, including all complications.

**Results:** Patients' mean age was 43.2 ± 13.6 years and BMI 27.8 ± 5.7 kg/m<sup>2</sup>. The FIGO stages were: IB2 = 6.2 %, IB1 = 75.3 %, IA2 = 17.3 %, and IA1 = 1.2 %. Tumor histology was 51.6 % squamous, 39.5 %, adenocarcinoma, and 8.6 % adenosquamous. Mean operative time was 194 ± 40 min, estimated blood loss (EBL) 92 ± 63 mL, and no laparotomy conversions. The transfusion rate was 3.7 %. Mean pelvic node count was 20.6 ± 9.1. Infra-mesenteric aortic lymphadenectomy was performed in 28.4 % of cases (mean 6.0 ± 4.3 nodes). Positive nodes were identified in 16 % of cases, all pelvic. Hospital length-of-stay was 1.09 ± 0.43 days. Major complications occurred in 18 (22 %) cases; one intra-operative ureteral cautery complication required temporary stenting. Five (6 %) uretero-vaginal fistula resolved with ureteral catheters and bladder drainage; 3 (3.7 %) cases required urologic operative repairs. There was no fistula after case #34 following elimination of PK bipolar energy at the vesico-uterine ligament. Other complications included lymphocysts requiring drainage 4 (4.9 %), cuff dehiscence 1, cuff bleeding 1, and cuff bleeding 1.

**Conclusions:** RARH is an efficient and feasible procedure with low transfusion rate, shorter hospital stay and improved operative measures. Ureter-related complications were excessive during the learning curve possibly due to use of bipolar PK forceps near the vesico-uterine ligaments.

## 8 Robotically assisted laparoscopic microsurgical tubal reanastomosis: A retrospective study

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**Objective:** To evaluate the pregnancy and delivery outcome of robot-assisted tubal reanastomosis. The main measures outcome was to

analyze the distribution of time to conception and to estimate the crude pregnancy and birth rates at 2 years.

**Methods:** This was a retrospective cohort study conducted at a university hospital. Ninety-seven patients with available follow-up who underwent the reversal of tubal ligation, with a median age of 37 years (range 24–47) were part of the study. The intervention was tubal reanastomosis by robot-assisted laparoscopy.

**Results:** The overall pregnancy and birth rates were 71 % (95 % CI: 61–80 %) and 62 % (95 % CI: 52–72 %). Ninety-one percent (95 % CI: 76–98 %) of patients less than 35 years of age became pregnant and 88 % (95 % CI: 72–97 %) delivered at least once. The corresponding pregnancy and delivery rates were 75 % (95 % CI: 57–89 %) and 66 % (95 % CI: 47–81 %) between 36 and 39 years of age, 50 % (95 % CI: 25–75 %) and 43.8 % (95 % CI: 20–70 %) between 40 and 42 years of age, 33 % (95 % CI: 10–65 %) and 8.3 % (95 % CI: <1–38 %) after the age of 43.

**Conclusion:** This study reports satisfactory birth rates after tubal reanastomosis by robot-assisted laparoscopy in patients aged 40 years or less.

### 9 Robot assisted laparoscopic pelvic lymphadenectomy in gynecologic cancer patients: Multi-centric audit for the 2012 SERGS meeting

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**Objective:** To determine the feasibility and safety of robotic pelvic lymphadenectomy for gynecologic cancer patients.

**Methods:** Members of the SERGS have been asked to participate to a retrospective audit of robotic pelvic lymphadenectomy as part of the procedure to take care of pelvic malignancies. Fifteen centers from Belgium, France, USA (Florida), Italy and Norway responded. From February 2003 to May 2012, 994 gynecologic cancer patients underwent robot-assisted laparoscopic pelvic lymphadenectomy.

**Results:** The main indications were cervical cancers (n = 317; 32 %), endometrial cancers (n = 671; 67.5 %), ovarian cancer (n = 6; 0.5 %). Robotic pelvic lymphadenectomy was performed using transperitoneal approach. The median age and BMI were 59 years (range 18–89) and 27 kg/m<sup>2</sup> (range 16–52), respectively. The median number of nodes was 17 (range 1–59). The median estimated blood loss was 100 ml (range 0–1,500). Conversion and transfusion rates were respectively 0.6 and 2.9 %. Peri- and short-term post-operative complications occurred in 6.1 and 5.8 %, respectively. The median hospital stay was 2-days (range 0–60). After a median follow-up of 14-months, eight (0.8 %) patients died and 28 (2.8 %) others patients experienced recurrence. Details on complications, oncologic management and oncologic outcomes will be presented at the time of the meeting.

**Conclusions:** This large international series provides data supporting feasibility and safety of robot assisted pelvic lymphadenectomy

performed as part of the treatment of pelvic malignancies. Conversion, transfusion and complication rates are low, hospital stay is short and oncologic outcomes are encouraging.

### 10 da Vinci<sup>®</sup> robotic hysterectomy: Results of an international collaborative group pooled data analysis

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**Objective:** To describe perioperative outcomes for robotic-assisted hysterectomy (RAH) from a collaborative retrospective database compiled from 14 member institutions of the Society of European Robotic Gynecological Surgery (SERGS).

**Methods:** Patients who underwent RAH for benign and malignant diagnoses were included in the SERGS database. Patients were included during the first 3–4 years robotic experience of each center. The database criteria included were demographic information, body mass index (BMI), surgical indications, surgical procedures, perioperative and post-operative morbidities, operative time (OT), estimated blood loss (EBL), conversions to laparotomy or laparoscopy, post-operative length-of-stay (LOS), specimen weight, and pathology.

**Results:** Eight-hundred-fifty one patients have been submitted to the database. Of these, 674 (79 %) underwent hysterectomy and 177 (21 %) underwent hysterectomies with pelvic lymph node dissections. Mean age and BMI were 55 years (range 24–92) and 29 kg/m<sup>2</sup> (range 16–67.5), respectively. Histology was benign in 501 (59 %) cases and malignant in 350 (41 %) patients. Mean OT was 138 min (range 55–450), mean console time was 112 min (range 25–420). Median EBL was 50 mL (range 0–3,000) and mean uterine weight was 174 g (range 23–1732). Median post-operative hospital LOS was 3.0 days (range 1–60). Conversion to laparotomy occurred in 10 (1.3 %) cases. Intra-operative major complications (NICE criteria) occurred in 8 (0.9 %) and post-operative morbidity was identified in 47 (5.5 %) cases.

**Conclusions:** In this pooled data analysis from 14 international centers, robotic hysterectomy was associated with low morbidity and conversion rates to laparotomy during the early phases of each center’s robotic surgery program. This collaborative database provides a broader view of perioperative outcomes than what is possible from single institution series, and may serve as a baseline for initial clinical outcomes for new robotic programs. Future studies can compare early and late perioperative outcomes for institutions stratified by program volume and/or maturity.



## 11 Evaluation of a laparoscopic training program with or without robotic assistance

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**Objective:** To validate the practice of pelvic-trainer (PT) in the training of interns in obstetrics and gynecology and compare trainings with and without robotic assistance.

**Materials:** This project concerns a medical education study. Interns of gynecology were randomized to participate in succession to PT sessions in traditional laparoscopic (TL) or with robotic assistance (LRA). Four exercises and theoretical training, similar from a workshop to another, were proposed. Students were evaluated before and after training, quantitatively (timing) and qualitatively (video evaluation by an outsider observer). The period of training was free.

**Results:** Four sessions with 12 residents were spaced of 2.3 months on average. For any exercise and any workshop associated, the qualitative improvement (score) is 15 % and for timing is 50 % after training. The training LRA allows a quantitative significant for all years while TL does not allow for complex exercises. There is a significant trend to improve qualitative marks in TL ( $p = 0.065$ ). Post-training validation rates above 70 % whatever the criterion of learning. Post-training validation rates above 70 % whatever the criterion of seniority. The number of attempts is correlated to the level of the internal (initial score per training). But it does not improve prognosis internally. The satisfaction rate is high with an internal application practice pelvic-trainer until the fourth year for 75 % of them.

**Conclusions:** The advantage of this training (TL and LRA) has been studied in the training of interns in gynecology. It highlights the improvement of practice in laparoscopy and stresses the importance of training with robotic assistance.

## 12 Robotic compartmental resection in uterine cancer: TMMR, FMMR and PMMR

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To define technique of robotic surgery in ontogenetically based compartment surgery in uterine cancer. Compartmental resection in cancer surgery based on embryonic development of tissue systems has been shown to achieve excellent locoregional tumor control in rectal (Total Mesorectal Excision, TME) and cervical (Total MesoMetrial Resection, TMMR) cancer. Hoeckel has shown in a monocentric study ( $n = 221$ ) that surgery alone (TMMR and therapeutic lymphonodectomy) without any additional radiotherapy may achieve 98 % locoregional control at median follow-up of 41 month in stage IB to IIB cervical cancer (Hoeckel et al., *Lancet Oncology* 2009; 10:683–692). Adoption of TMMR to robotic surgery has been performed by the author in collaboration with M. Hoeckel and demonstrated in Milan (ESGO) and Toronto (Soc. Pelvic Surgeons) in 2011. However, in analogy to TMMR, fertility preserving surgery by

FMMR (Fertility Preserving MesoMetrial Resection) may also be an alternative to radical trachelectomy in cervical cancer; furthermore, in endometrial cancer ontogenetically based surgery can be performed as PMMR, Peritoneal MesoMetrial Resection, also may potentially increase locoregional tumor control without additional radiotherapy. Principles of ontogenetically based compartment surgery in uterine cancer with special respect to adoption of these strategies to robotic surgery will be demonstrated in this presentation. Personal experience with respect to the technique (video demonstration) and peri-operative outcome will be discussed.

## 13 Robot-assisted laparoscopic treatment of rectovaginal deep infiltrating endometriosis with rectal segmental resection

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Deep infiltrating endometriosis with colorectal involvement is a complex disorder, often requiring segmental bowel resection. The surgical treatment must be as complete as possible because the functional results depend on radical excision. These procedures are both complex and risky because of the invasion and infiltration of the pelvic organs and neighboring vascular and nerve structures. Several surgical procedures must be performed by experienced teams including gynecologists, gastrointestinal surgeons and urologists. Laparoscopy is considered as the gold standard for diagnosis and currently the surgical resection can be feasible by laparoscopy in expert hands. Robot-assisted procedures have revolutionized minimally-invasive surgery by providing the surgeon with greater precision in resection procedures due to the stability of the image, the 3D visualization and the seven degrees of freedom of the instruments. Currently, there is no study assessing of the mean duration of surgery, post-operative complications, the main hospital stay and the occurrence of pregnancy after robot-assisted laparoscopic treatment of rectovaginal deep infiltrating endometriosis with rectal segmental resection. Our presentation describes step-by-step the surgical procedure and the results of preliminary study about 10 rectal segmental resections with robot assistance.

## 14 Robotic radical hysterectomy in cervical carcinoma: Analysis of 82 cases

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**Objective:** To analyse the operative results of robotic radical hysterectomies (RRH) in cervical cancer in Belgium.

**Methods:** Eighty-two RRH were performed in patients with cervical carcinoma between April 1st 2007 and January 31st 2012.

**Results:** RRH was performed using the da Vinci<sup>®</sup> Surgical System in cervical carcinoma FIGO (2009) stage Ia1 (n = 4), Ia2 (n = 6), Ib1 (n = 58), Ib2 (n = 3), IIa1 (n = 5), and IIb (n = 6). Median age was 47 years (range 30–80), median BMI 24.0 kg/m<sup>2</sup> (range 18.2–40.9), median number of pelvic lymph nodes 23 (range 5–59), median operative blood loss 150 mL (range 20–1,000), median hospital stay 5-days (range 2–19), and median operative time 250 min (range 150–450). Peri-operative complications included two bladder lesions (sutured robotically), one compartment syndrome of the lower leg, and one ureteral lesion (treated with stent). Post-operatively 7 (8.5 %) patients complained of bladder retention for more than 28-days and one (1.2 %) patient developed a vesicovaginal fistel. Six patients had neoadjuvant chemotherapy prior to surgery (all stage Ib2 or II) and 13 (16 %) patients were post-operatively treated with radiotherapy because of unfavourable prognostic variables. At the time of analysis (median follow-up of 22 months), 8 (10 %) recurrences cases were observed and two patients had died.

**Conclusion:** This series on 82 patients treated with RRH shows that RRH is feasible with an acceptable morbidity, and a disease-free and overall survival as expected in this reported population.

### 15 Uterus preservation in pelvic organ prolapse using robot assisted laparoscopic sacrohysteropexy: Quality of life and technique

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**Objective:** Measuring quality of life of women with pelvic floor disorders is critical when evaluating a therapy. The aim of this study was to profile health-related quality of life of women with pelvic organ prolapse who were treated with robot assisted laparoscopic sacrohysteropexy (RALS). Furthermore, we compared operative characteristics with current literature and described the surgical technique.

**Methods:** This prospective cohort study of 15 women contains the largest European cohort so far of women with uterovaginal prolapse who were treated with RALS. RALS was performed with uterus preservation. Quality of life was assessed pre- and post-operatively using the UDI/IIQ validated self-questionnaire. Clinical and operative data were collected over 24 months. Statistical analysis was performed with the paired *t* test.

**Results:** Pre-operative overall well-being was scored 71.4 % out of 100 %. After surgery, this percentage increased to 81.6 % (*p* = 0.001) with significant decreasing feelings of nervousness, frustration and embarrassment. Sexual functioning also improved; however, not statistically significant. Mean operative time was 241 min (range 155–334). Operative time decreased considerably with gained experience and was identical to operative times of abdominal sacrocolpopexy and classic laparoscopy. Average blood loss was less than 50 ml and the mean hospital stay was 2-days. A total of 94.3 % of all patients were very satisfied with the result after RALS.

**Conclusion:** Health-related quality of life improves significantly after RALS with high rates of patient satisfaction. RALS is a safe and effective treatment of pelvic organ prolapse with operative times comparable to abdominal sacrocolpopexy and classic laparoscopy in current literature.

### 16 Robot-assisted myomectomy: A multi-centered retrospective study of European results

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**Objective:** To assess the current techniques and peri-operative outcomes for robotic myomectomy in Europe.

**Methods:** Members of the Society of European Robotic Gynecological Surgery (SERGS) performing robotic myomectomy were asked to retrospectively contribute their results to a single database recording patient characteristics and peri-operative outcomes.

**Results:** Four centers and six surgeons contributed 66 cases to the database performed between March 2007 and March 2012. Patient characteristics were: mean BMI 23.2 kg/m<sup>2</sup>, mean age 36 years, no prior surgery in 57.6 %, and previous embolization in 10.6 % of cases. Symptoms were pain in 54.5 %, abnormal bleeding in 36.4 %, fertility problems in 30.3 %, and polyuria in 28.8 % of cases. The mean size of fibroid was 7.4 cm, median number 2, and mean weight per case of 180 g. 4 arms and side-docking were used in 81.8 and 57.6 % of cases, respectively. Mean skin-to-skin operative time was 202 min, mean estimated blood loss 307 ml. The cavity was entered in 21.2 % of cases (19.7 % of cases were sub-mucosal). Complications were significant blood loss in 6.1 % of cases, ureteral injury in 1.5 %, and conversion to laparotomy in 1.5 %. The median length of stay was 3-days. Twenty-eight women wished to become pregnant and there have been 14 pregnancies to date resulting in eight live births (six caesarean sections, two vaginal births, one postpartum haemorrhage), and three miscarriages.

**Conclusions:** Robot-assisted myomectomy is a relatively new technique in Europe and is not widespread in its use. This multi-centered study gives a unique snapshot of the current situation with results that are comparable to conventional laparoscopy. Robot-assistance improves the ability to dissect fibroids out and suture the resulting defect when using the fourth arm and using the wristed ability of the instruments.

### 17 Robot-assisted radical parametrectomy (upper vaginectomy) in patients with malignant gynecological tumors

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**Objective:** To describe the operative technique of the robotic radical parametrectomy and analyze the data in regard to its radicality and perspectiveness based on the contemporary knowledge of laparoscopic anatomy of the pelvic retroperitoneal space and on our operational material.

**Methods:** A retrospective study of seven patients was performed in the Gynecologic Oncology Clinic of the Medical University—Pleven from February 2011 to May 2012. Patients underwent robot-assisted radical parametrectomy after prior operation. The morphological results before and after the radical surgeries were analyzed. The post-

operative complications, duration of surgery, blood loss, and length of hospital stay are described.

**Results:** The upper part of the vagina, parametrial tissue and pelvic lymph nodes bilaterally of all seven patients were removed. The average age of the operated women was 56.43 years. Invasive squamous carcinoma was found in four, endometrial adenocarcinoma in two, and clear-cell papillary adenocystic cervical carcinoma in one patient. The average number of the lymph nodes removed was 11.2, and only in one woman metastatic lymph nodes were detected. The average duration of surgery was 229 min. The intra-operative blood loss was 147 ml. Intra-operative lesion of the urinary bladder was performed on one patient and in another patient on the tenth post-operative day; a vesicovaginal fistula was found. The length of hospital stay was 5-days.

**Conclusion:** The basic surgical and anatomical principles of robot-assisted radical parametrectomy do not change but the 3D image allows more detailed interpretation of the morphological structures and their interrelations in the pelvis.

## 18 Standardization of one approach to robotic-assisted pelvic and aortic lymphadenectomy for patients with endometrial cancer including the morbidly obese

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**Objective:** The purpose of this study is to describe our robotic-assisted laparoscopic surgical technique for pelvic and aortic lymphadenectomy (PAL) including infra-renal aortic (IRA) dissection, performed with hysterectomy for women with endometrial cancers (EC).

**Methods:** Peri-operative outcomes data from the robotic surgery registry was compared on an annual basis over the first 4 years of the program for common factors including operative time (OT), estimated blood loss (EBL), length-of-stay (LOS), lymph node yields, and complications. The specifics of port placement, surgical technique, intra-operative management of the field during dissection, avoidance of complications, and post-operative management are discussed. Data from the first year of a single center-docked approach to IRA dissection is reviewed.

**Results:** From 6/06 to 6/10, 391 patients with EC underwent robotic hysterectomy with pelvic lymphadenectomy and 221 (57 %) also underwent aortic dissections. OT decreased from a mean  $173 \pm 56$  min to  $148 \pm 34$  min ( $p < 0.001$ ) while body-mass index (BMI) increased from  $28.2 \pm 7.1$  to  $31.7 \pm 7.4$  kg/m<sup>2</sup> ( $p < 0.01$ ) during this time. Mean EBL and median LOS remained constant at  $<100$  ml and 1 day, respectively, and there were only 2 (1.2 %) transfusions. Pelvic nodes increased from  $12.5 \pm 8.3$  to  $18.9 \pm 8.0$  ( $p < 0.001$ ) and aortic nodes increased from  $6.6 \pm 5.0$  to  $11.0 \pm 6.7$  ( $p < 0.001$ ). During the following year 2010–2011, 47 patients underwent aortic lymphadenectomy by the primary author and infra-renal dissections were accomplished in 34 (72 %) cases [BMI 32 kg/m<sup>2</sup> (range 20–56)]. Aortic lymph node yields were  $13.1 \pm 6.3$  for infra-renal dissections compared to  $6.5 \pm 4.0$  for dissections to the inferior mesenteric artery (IMA). Mean OT was  $178 \pm 31$  min for infra-renal cases. There were no transfusions and no laparotomy conversions. Two (4.2 %) cases of chylous ascites occurred. Port placement and operative technique are described in detail and video links are provided.

**Conclusions:** The robotic learning curve for pelvic and aortic dissections continued to evolve in our program over 4 years, with improvements in OT and lymph node yields despite an increase in BMI. Infra-renal dissections were accomplished in 72 % of recent cases undergoing peri-aortic lymphadenectomy.

## 19 Comparison of peri-operative outcomes associated with robotic-assisted hysterectomy and myomectomy

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**Objective:** To compare the peri-operative outcomes in patients undergoing robotic-assisted hysterectomy (RAH) and robotic-assisted myomectomy (RAM) performed by a single surgeon.

**Methods:** Using the New York Hospital Queens surgical database, we identified patients who underwent either RAH or RAM from May 2010 to March 2012. We examined the relationship between the patients' peri-operative outcomes and the type of surgery performed (RAH vs. RAM). An independent sample *t* test was used for comparison of means, and Mann–Whitney *U* test was used for non-parametric comparisons. A *p* value of  $<0.05$  was considered statistically significant.

**Results:** We identified 199 RAH patients and 100 RAM patients during the study period. Patients who underwent RAM were found to be significantly younger and more likely to be nulliparous. We found decreased operative time (112 vs. 129 min,  $p = 0.03$ ) and similar blood loss in the RAH group despite larger uterine size (246 vs. 148 g,  $p < 0.0001$ ). The length of hospital stay was similar in the two groups. We then performed a separate analysis for patients with large uteri, defined as specimen weighing over 250 g. When compared to RAM, RAH was associated with a significant decreased operative time (127 vs. 189 min,  $p < 0.0001$ ) as well as blood loss (50 vs. 100 mL,  $p = 0.01$ ).

**Conclusions:** Robotic hysterectomy is associated with shorter operative time and decreased blood loss, especially in patients with large uteri. While both RAM and RAH are safe surgical modalities for treatment of symptomatic leiomyomas, we should continue to recommend RAH to patients who no longer desire fertility preservation.

## 20 Robot-assisted para-aortic lymphadenectomy: Surgical results

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**Objectives:** To report robotic-assisted laparoscopic para-aortic lymphadenectomy (PAL) in patients with gynecologic cancers, and to compare surgical results of different approaches for isolated or combined aortic lymphadenectomy.

**Methods:** Retrospective multi-centric study of patients who underwent robotic aortic lymphadenectomy between November 2004 and March 2012 ( $n = 487$ ). Twelve centers have taken part in the study, in Europe and USA (Orlando). The following data were considered: age, body mass index (BMI), indication, type of surgical approach (trans-peritoneal or extra-peritoneal), associated surgeries, intra-operative data, surgery duration, blood loss, immediate outcomes, lymph node count, hospital stay and complications. Surgical procedures were performed for 12 % (58/487) by extra-peritoneal and 88 % (429/487) by trans-peritoneal. Trans-peritoneal procedures involved isolated para-aortic lymphadenectomy in 17 % (72/429) or combined with other surgical procedures in 83 % (357/429).

**Results:** Aortic staging has been realized for endometrial cancer in 257 (52.8 %) cases, for cervical cancer in 157, for ovarian/tubal cancer in 64 cases. For the whole population, the mean nodes removed were  $12.6 \pm 8.08$ , operative time was  $217 \pm 85$  min, and hospital stay was  $2.8 \pm 3.25$  days. There were four (0.8 %) conversions to laparotomy and two (0.4 %) conversions to laparoscopy. Seven (1.4 %) vascular injuries and two (0.4 %) urinary injuries occurred, and 10 (2.1 %) patients were transfused. The most common post-operative complication was lymphocysts in 32 (6.6 %) cases. For trans-peritoneal approach, the average number of lymph nodes removed was higher in isolated group than combined group (95 % CI: 7.29–3.52,  $p = 1.5 \times 10^{-6}$ ). For isolated PAL, the hospital stay was shorter in the extra-peritoneal group procedure than trans-peritoneal group (95 % CI: 1.35–0.35,  $p = 0.0011$ ).

**Conclusions:** This study demonstrates the feasibility of robotic PAL. In terms of number of nodes removed, more nodes were removed with isolated procedures than combined procedures. Extra-peritoneal approach decreases a shorter hospital stay. Providing a robot-docking dedicated to PAL and different from pelvic surgery may be useful to improve outcomes and reduce morbidity.

## 21 French multi-centric results of adjuvant surgery after concomitant radiochemotherapy for locally advanced cervical cancer

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**Objective:** Concomitant radiochemotherapy is the standard treatment for locally advanced cervical cancers (from stage IB2 to stage IV). The place of adjuvant surgery is controversial. The aim of this study was to report the French experience of robot assisted laparoscopy for patients with locally advanced cervical cancer at the time of the completion surgery, and to evaluate feasibility and morbidity.

**Methods:** All centers in which robot assisted laparoscopy was available were interviewed about their experience and each patient who underwent adjuvant surgery for locally advanced cervical cancer after concomitant radiochemotherapy from 2007 to 2012 were included. Retrospectively, clinical characteristics, peri- and post-operative data, and data from the follow-up have been collected.

**Results:** Ninety-three patients were included, from six centers. All of them underwent hysterectomy and bilateral oophorectomy with robot assisted laparoscopy, and 82 underwent pelvic lymphadenectomy. Para-aortic lymphadenectomy was mainly done during initial staging, but for eight of these patients, it was done at the time of completion surgery. The median age was 48 years (range 24–82), and median BMI was 23 kg/m<sup>2</sup> (range 17–25). The conversion rate was 0 %. The median operative time was 210 min (range 119–480), the median hospital stay was 3.5 days (range 2–24). Forty-two (44 %) patients had post-operative complications. Among them, 25 (60 %) was lymphatics issues. There were 12 (13 %) cases with severe complications, defined by a grade 3 or 4 according to Dindo et Clavien classification. Thirty-nine (42 %) patients had residual diseases on histological analysis, and eight patients had lymph node involved.

**Conclusions:** This multi-centric study suggests that the technique is feasible for this specific indication. Post-operative morbidity is high, but the rate of severe complications seems acceptable. Compared to available data from the literature concerning conventional laparoscopy, robotic assistance could provide a benefit regarding the need for conversion to laparotomy.

## 22 To assess pregnancy outcomes in women undergoing robot-assisted myomectomy for symptomatic leiomyomatauteri

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**Objective:** To assess pregnancy outcomes in women undergoing robot-assisted myomectomy for symptomatic leiomyoma tauteri.

**Methods:** This retrospective multicenter study included all women who had robot-assisted myomectomy during October 2005–November 2010 and subsequently became pregnant. Characteristics of myomectomies, pregnancies and deliveries were described. Characteristics of the myomas were examined in relationship to time to conception, spontaneous abortion, and pre-term delivery up to 35 weeks using *t* tests, Chi square statistics, and regression analyses.

**Results:** During the study period, 483 women underwent myomectomies resulting in 127 pregnancies and 92 deliveries. Median age at myomectomy was 35 years (range 23–48) and 57.4 % of women were overweight or obese. The median number of myomas removed was 3 (range 1–14) with a median size of 6.9 cm (range 3–18) and median weight of 149 g (range 8–665). Entry into the endometrial cavity occurred in 20.6 % of patients. Median time to conception was 9.3 months (range 0.7–65.4). Assisted reproductive techniques were employed in 39.4 % of these women. Seven twin pregnancies and two triplet pregnancies occurred, for a multiple pregnancy birth rate of 9.8 %. Spontaneous abortions occurred in 18.9 %. Pre-term delivery prior to 35 weeks occurred in 17.4 % of cases. One (1.1 %) uterine rupture was documented.

**Conclusions:** We report a case series on pregnancy outcomes after robotic myomectomy. Despite a high prevalence of women with advanced maternal age, obesity and multiple pregnancy, our results compare favorably with those reported for laparoscopic myomectomy. Robotic myomectomy can be safely offered to women of reproductive age needing conservative surgical treatment for uterine fibroids.



### 23 Combined robotic procedures, pelvis and upper abdomen. Standardization with two surgical approaches: High aorto-cava lymphadenectomy by transperitoneal robotic approach using a double docking and 180° rotation of operation table

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**Objectives:** To describe and standardize the double robotic approach: (1) Upper inlet (cranial) of the arms of the da Vinci<sup>®</sup> in order to expose upper abdomen, and (2) Repositioning the robot to on side docking next to the right leg of the patient, to access the pelvic area. The second objective was to demonstrate the feasibility of this robotic approach in high-grade endometrial cancer or early ovarian cancer.

**Methods:** Since November 2009, up to the present day, 31 patients have been included in this study. All of them included an upper abdominal approach to perform aorto-cava lymphadenectomy and then 180° rotation patient and side re-docking in order to do pelvic approach.

**Results:** Median of age was  $59.8 \pm 15.3$  years (SD 15.3) and median BMI was  $26.8 \pm 4.1$  kg/m<sup>2</sup>. We spend an average of 79 min (range 2–150) to complete aorto-cava dissection. Time in double docking with 180° rotation of operation table was 15.7 min (range 5–30). There was statistically significance difference past the first year (19 vs. 14 min,  $p = 0.02$ ). Median of nodes extracted was 12.0 (range 1–44) and the length of hospital stay was 2.3 days (range 1–4). Complications were in two late lymphocele cases (one did not need any treatment and the other needed 4-weeks of dietetic treatment and 4 paracentesis) and two vena cava bleeding that requires a 5/0 Prolene suture.

**Conclusions:** Aorto-cava robotic lymphadenectomy is feasible and easy to do with double docking and rotation of the operation table. The learning curve is quick and secure when you have sufficient experience in cancer surgery even without having previously performed the procedure laparoscopically.

### 24 How do different centres perform robot-assisted sacrocolpopexy?

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**Objective:** Sacrocolpopexy is considered the gold standard surgical treatment for apical prolapse yet no defined surgical technique exists. The goal of this study is to evaluate the different methods of robot-

assisted sacrocolpopexy (RASCP) and to determine if a minimal standard of this procedure exists.

**Methods:** A questionnaire containing items related to each potential step of a RASCP was created and was electronically sent to 60 urogynecology centres in Europe and the United States (US) who had potential access to a robot.

**Results:** Overall, 37/60 (40 %) responses were received, of which 22 reported not performing RASCP, leaving 15 centres with completed questionnaires for data collection. The geographic distribution of the respondents was 13 from Europe and two from the US. Pre-operatively, 100 % reported administering prophylactic antibiotics. There was an equal split between side and central docking. Wide variability in vaginal and rectal manipulation existed and responses varied according to presence or absence of a uterus: 3/15 (20 %) reported no manipulation, 5/15 (33 %) use a bendable blade, and the remainder reported using a retractor of their own design (2), EEA sizers (1), Colpoprobe (1), metal bougie (1), Koh cup on Rumi Arch (1), Gauze (1) and armed sponge (1). Only one-quarter of the respondents reported using a rectal probe. When queried regarding concomitant hysterectomy and RASCP, four reported never doing so, whereas the remaining 11 would. If a hysterectomy is performed, all centres use the supracervical technique. All centres reported utilizing polypropylene mesh of which 10 tailor the mesh and five use a pre-fabricated Y-shaped mesh. Significant variability in the type and number of sutures used to attach the mesh, exist: 13/15 (86 %) reported using permanent sutures, of which five were monofilament and eight multifilament sutures. Most reported using the same suture material to affix the mesh at the vagina and promontory. However one centre utilizes mono- (vagina) and multifilament (promontory) sutures and one centre absorbable staples at the vagina and multifilament sutures at the promontory. One-quarter reported using three sutures to affix the anterior and posterior meshes respectively, whereas the remainder used 4–8 stitches. All reported attaching the mesh to the apical vagina or cervix. Techniques of posterior mesh attachment included seven to the upper half of the vagina only, four to the lower half, and four do not attach the mesh to the vagina itself but to the levator muscle on either side and to the uterosacral ligaments, three include the rectum for mesh attachment. The extent of anterior mesh attachment ranged from 7- to the internal urethral orifice, 1—only the apical vagina, and the remainder—the proximal third of the vagina. Half reported checking for, and removing, stitches put through the vaginal wall with a vaginal exam. Six (40 %) reported attaching the mesh to the promontory, the others to S1 or S2. For sacral attachment, seven reported using two stitches but one used a single suture and four centres used 3–4 stitches. The use of tackers was reported by three centres. All reported closing the peritoneum, 14 with an absorbable and one with a permanent running suture. Of the 14 absorbable, six used a barbed suture.

**Conclusion:** Wide variability exists in surgical technique for RASCP. It is unclear how different RASCP techniques influence outcome, recurrence and complication rates.

### 25 Robotic single-site hysterectomy in early endometrial cancer: A pilot study

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**Objective:** To evaluate the feasibility and the safety of robotic single-site radical hysterectomy (RSSRH) in low-risk early endometrial cancer.

**Methods:** Patients with clinical low-risk early endometrial cancer were enrolled in prospective cohort trial. All surgical procedures were performed through a single 2–2.5 cm umbilical incision, with a multi-channel system consisting of a five-lumen port provides access for two Single-Site instruments, the 8.5 mm 3DHD endoscope, a 5/10 mm accessory port and insufflation adaptor.

**Results:** Between December 2011 and June 2012, 17 patients were included in our pilot study. The median age of the patients was 64 years (range 42–84) and median body mass index (BMI) was 29.1 kg/m<sup>2</sup> (range 18–52). One patient reversed to vaginal surgery. The median docking time, console time, and total operative time was 9.3 min (range 5–14), 47.5 min (range 45–51) and 98.3 min (range 70–147 min), respectively. The operating time was strongly correlated with BMI of the patients, e.g., in two patients with high BMI (33.6 and 34 kg/m<sup>2</sup>), the operating time (OT) was longer than 140 min, and in four patients with BMI less than 25 kg/m<sup>2</sup>, the median operating time was 85 min (range 70–95). Moreover, after one half of the cases (six patients), we observed a significant decrease in the median OT (82 vs. 112 min). The median blood loss was 76.7 mL (range 50–150 mL). No laparoscopic/laparotomic conversion was registered, and no insertion of additional ports was necessary. The median time to discharge was 2-days (range 1–3). Neither intra-operative nor post-operative complications occurred.

**Conclusions:** RSSRH is technically feasible in patients affected by low-risk early endometrial cancer. However, additional studies with gynaecologic oncologic cases should be performed to explore the possible benefits of RSSRH.

### III. Posters Session

#### 1 Cost of robotic gynecological surgery in a U.K. setting

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**Objective:** To evaluate the cost of benign robotic gynaecological surgery in a District General Hospital in the U.K. and to examine if the National Health Service (NHS) and economic situation encourage the use of robotic technology.

**Methods:** A retrospective financial analysis of strategic costs, specific robotic equipment costs, and full absorption costing for open, laparoscopic and robotic surgery for a variety of benign procedures judged against the National Tariffs that the hospital receives for each case.

**Results:** The robot incurs a cost to the hospital whether it is used or not of £199,000 per annum due to depreciation and maintenance contract. This cost can be spread if the robot is used more frequently (£1,990 per case for 100 cases per year or £265 per case for 750 cases). The cost of a robotic hysterectomy for theatre equipment and sterilization is £1,930.29 per case versus £79.94 for open. Full absorption costing increased this amount to £4,354.31 making it more expensive than either open (£2,926.50) surgery even compensating for reduced stay and other factors. The National Elective Tariff for the same procedure was £2,480.04 suggesting a loss to the hospital of £1,874.27 per case. The fact that open hysterectomy is the cheapest approach for the NHS is a perverse incentive to continue to let open surgery be the main approach in benign gynaecology.

**Conclusions:** In order to get robotics closer to cost neutral at hospital level other strategies need to be employed to reduce the deficit.

#### 2 Is it possible to remove a solid multifibroid robotically?

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**Objective:** To present the extra-peritoneal approach of robotically-assisted total hysterectomy and adnexectomy and highlight its effectiveness in removing a large multi-fibroid uterus, without conversion to laparotomy.

**Case Presentation:** A 49-year old, para 1 (CS1), pre-menopausal woman presented with a multifibroid uterus and heavy vaginal bleeding.

**Methods and Procedures:** da Vinci<sup>®</sup>-S Robotic System was used. Side-docking and five ports, were implemented, all of them above the umbilicus (2 robotic ports, 1 Hasson for the camera and 2 auxiliary laparoscopic ports of 5–12 mm, were used). We used alternatively a 0 or 30 degrees camera. A 10 mm strong clamps was applied on the auxiliary ports, in an alternating manner, pulling the uterus on the opposite site of the surgeon's dissection field. Retroperitoneal dissection of the uterine ligaments and vessels was performed as follows: the retroperitoneal space was entered in between the round ligament and the ovarian vessels, on both sides. The ureters were identified and dissected along until the cardinal ligament. The left ovary was removed for better visualization. The bladder and the rectum were dissected and detached from the cervix. The uterine artery was cauterized, on both sides, while the ureter was under direct vision. Eventually the vagina was entered and the uterus was freed. Due to the large size of the uterus and the narrow vagina, delivery of the uterus was not possible, even when it was dissected in two pieces, so one piece was delivered through the vagina, while the remaining part was removed via morcelation.

**Conclusion:** Even a very large uterus can be removed endoscopically using the da Vinci<sup>®</sup>-S system and side-docking, if the surgeon dissects through the extra-peritoneal space, using helpful tricks.

#### 3 Feasibility of robot-assisted laparoscopy for deep pelvic endometriosis: French multi-centric retrospective study of 53 cases

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**Objective:** To assess the feasibility of robot-assisted laparoscopy for deep pelvic endometriosis in a French multi-centric retrospective study.

**Materials:** We collected medical and surgical data about deep infiltrating endometriosis resections that we performed in Lille, Toulouse and Grenoble, using robot-assisted laparoscopy (da Vinci<sup>®</sup>, Intuitive Surgical Inc.). Fifty-three patients were included in this study.

Different procedures were performed: partial bladder resection, uterosacral ligament resections, ureteral re-implantation, hysterectomy, colorectal resection, fimbrioplasty, and myomectomy.

**Results:** The mean age was  $33.9 \pm 7.1$  years, and the mean parity was  $0.5 \pm 0.9$ . All patients reported chronic pelvic pain, associated with urinary tract symptoms in case of bladder endometriosis. Before surgery, mechanical bowel preparation or double-j stenting were prescribed, depending on the endometriosis location. Sixty percent of patients complained of infertility. Surgical procedures mean time was  $183.3 \pm 49.7$  min, and mean length of stay was  $4.0 \pm 1.5$  days. Complete resection was possible in 98 % of cases. There was no conversion in classical laparoscopy or laparotomy, no intra-operative or post-operative complications (urinary tract or bowel injury). Surgical blood loss was less than 100 ml in 94 % and always less than 250 ml. Pathology diagnoses of surgical pieces concluded to endometriosis lesion in all cases.

**Conclusions:** This study includes all the French cases of robot-assisted laparoscopy in the resection of deep pelvic endometriosis. This study has demonstrated the feasibility of these surgical procedures without increasing of surgical timing, blood loss, intra-operative or post-operative complications. Optimized ergonomics and increased mobility of the instrument tips are beneficial in these difficult surgical procedures.

#### 4 Cost comparison between robotic and laparoscopic surgery for endometrial and cervical cancer

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**Objective:** The aim of our medico-economic study was to compare robotic surgery cost with conventional laparoscopic cost in endometrial and cervical cancers.

**Methods:** Since using da Vinci<sup>®</sup> Surgical System in 2008, we included in our study during 3-years' all laparoscopic and all robot-assisted radical hysterectomy for endometrial or cervical cancers. We used a hospital perspective. Direct costs were determined by examining each pathway. Actual costs were calculated for the 27 conventional laparoscopic hysterectomies and 30 robot-assisted hysterectomies, including initial cost of the robot and its maintenance. We estimated the complete medical care costs by adding the cost of consultations, surgery, and hospital stay after surgery to the cost of possible emergency consultation and/or hospitalization within two months after surgery. A sensitivity analysis was performed to evaluate the effect of changing variables.

**Results:** For endometrial cancer, average surgical cost for robotic-assisted surgery was €7,402 compared to €2,733 for conventional laparoscopic surgery. The cost difference median between robotic-assisted surgery and conventional laparoscopic surgery was €4,866 for the surgery. The cost difference median considering complete medical care was €4,601. For cervical cancer, average surgical cost with robotic-assisted surgery was €8,501 compared to conventional laparoscopic surgery €3,239. Post-operative hospitalization for robotic surgery was 4.7 days (range 2–13) versus 5.8 days (range 3–9) for laparoscopic group ( $p = 0.07$ ). Considering the complete medical care, the cost difference median reduced from €5,899 (surgery) to €4,153 (complete medical care). Sensitivity analysis results confirmed the cost overrun of robotic-assisted surgery; nevertheless, robotic additional cost could decrease by reducing operative time, ground occupation time, and hospital stay.

**Conclusions:** Conventional laparoscopy is less expensive than robotic-assisted surgery for the treatment of endometrial and cervical cancers. For cervical cancer, the cost burden between robotic-assisted surgery and laparoscopy is decreased when considering global cost. The robotic surgery extra cost could be reduced by optimizing ground occupation time and reducing operative time. Robotic surgery benefit for the patient and surgeon may counterbalance the cost overrun, this hypothesis is currently evaluated.

#### 5 Save our surgeons: Stress levels reduced by robotic surgery

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**Objective:** This study aimed to assess differences in user stress levels, as measured by skin conductance level (SCL) and changes in salivary cortisol, whilst performing straight stick (SSLS) or robotic-assisted laparoscopic surgery (RALS) tasks, to test the hypothesis that RALS is less stressful for the surgeon.

**Methods:** Sixteen medical students performed four tasks with both standard laparoscopic instrumentation and a da Vinci<sup>®</sup> robotic system. Blood pressure was taken before and after task performance. SCL and heart rate were recorded continuously using a NeXus-4 ambulatory monitoring device. Pre- and post-task saliva samples were collected to determine cortisol level using ELISA. Task performance was measured using a time-action analysis.

**Results:** Cortisol levels increased following task performance with SSLS vs. RALS, as did blood pressure; however, these did not reach statistical significance ( $p = 0.73$  and  $p = 0.22$ , respectively). As previously found, RMSSD ( $p < 0.01$ ) was significantly higher during RALS than SSLS, as was SDNN ( $p < 0.01$ ), a finding not previously described. RMSSD and SDNN are measures of heart rate variability, which increases with lower stress levels. SCL ( $p = 0.027$ ) and average heart rate ( $p = 0.04$ ) were significantly higher during SSLS than RALS task performance.

**Conclusions:** This confirms that RMSSD and heart rate are altered while performing SSLS and RALS tasks. Further studies are required to determine if changes in cortisol and blood pressure are significant. Importantly, SCL, a measure of sympathetic nervous system arousal and stress, was significantly higher with the SSLS, all supporting our hypothesis. Therefore, this study may have important implications for decreasing stress-induced surgeon fatigue.

#### 6 Reproducibility and accuracy of robot assisted and vaginal radical fertility sparing trachelectomy: Advanced procedures

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**Objective:** To assess accuracy and reproducibility of robot assisted laparoscopic abdominal fertility sparing radical trachelectomy in women with early-stage cervical cancer.

**Methods:** Using a prospective protocol relevant peri-operative and follow-up data from 13 consecutive women planned for robotic

radical trachelectomy between December 2007 and March 2012 were retrieved and compared with retrospective data from 12 women with a vaginal radical trachelectomy operated on between 2000 and 2007. The follow-up included a vaginal ultrasonographic measurement of the length of the remaining cervix and the position of the cerclage. For women with the robotic approach the protocol included peri-operative measurement of the length of the parametria and the vaginal cuff whereas in the vaginal group only data on vaginal cuff was available. Peri- and post-operative complications were compared.

**Results:** The length of the remaining cervix was equal between groups (robotic group median 10 mm (range 8–13), vaginal group median 11 mm (range 5–19) [ $p = 0.95$ ], whereas the mean distance from the cerclage to the inner cervical was significantly shorter and less variable in the robotic group [robotic mean 2 mm (range 1–4), vaginal mean 4 mm (range 2–7);  $p = 0.007$ ]. In the vaginal group, three cerclages were rejected and three women experienced a cervical stenosis within 1–41 months after surgery. Neither of these complications occurred in the robotic group; however, with a median follow time of 23 months. No recurrences occurred.

**Conclusion:** Robot assisted abdominal fertility sparing radical trachelectomy is a reproducible technique. It is equally accurate as the vaginal trachelectomy in terms of length of the remaining cervix and results in a significantly more exact placement of the cerclage. Peri-operative complications are rare and not more frequent compared with vaginal trachelectomy.

## 7 Identification of sacral plexus at robot radical hysterectomy

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**Objective:** To demonstrate our surgical technique of identification of sacral plexus in part of robot radical hysterectomy with extended lymphadenectomy. It is necessary to understand anatomy of deep sacral plexus to prevent the nerve injury in case of extensive lymphadenectomy in high-risk cervical cancer.

**Methods:** The clinical significance of sacral plexus is that an injury to the sacral plexus leaves the patient with a deficit in the sensation and/or movement and experience neuropathic pain in the lower limb supplied by the corresponding nerve(s) affected. Between March 2011 and December 2011, 24 consecutive patients underwent identification of sacral plexus in the part of nerve sparing radical hysterectomy for the treatment of early cervical cancer (FIGO stages IA2–IIA2). After extended lymphadenectomy, we could confirm sacral plexus, lumbosacral trunk, S1, S2 and S3.

**Results:** The mean total operating time was  $300.0 \pm 62.4$  min, and the mean console time was  $274.4 \pm 53.5$  min. The mean blood loss was  $64.0 \pm 31.8$  mL. The mean acquired pelvic lymph node was  $24.8 \pm 10.2$ , and the mean extended lymph node was  $16.9 \pm 9.1$ . The length of hospital stay averaged  $10.3 \pm 6.7$  days, and the mean days to normal residual urine ( $<100$  mL) were  $9.5 \pm 5.1$  days. No intra-operative complications or post-operative nerve injury occurred that required treatment.

**Conclusions:** It would be expected in sacral plexus identifying extended lymphadenectomy that the more number of lymph nodes and therapeutic benefits for improvement of survival. However, it needs to evaluate long-term survival benefit and functional benefits about identifying sacral plexus extended lymphadenectomy.

## 8 S. Anna Hospital's approach to robotics 2

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**Objective:** Robotic assisted surgery requires multi-professional skills and knowledge, thus we have created a robotic surgery project team.

**Methods:** Robotic surgery entails new approaches from both technical and theoretical point of view, the project team has been created involving professionals from different background as follows: doctors (gynecologist, urologist, general surgeon, anesthesiologist), nurses (scrub nurse, anesthetist nurse, operating room (OR) nurse, sterilization personnel), costs accountants, quality and safety control personnel, and trainers and education staff. Each member of the group has developed protocols focusing on specific aspects and problems of this new technique. Anesthetists draft profiles for patients eligible for robotics and list of pre-operative assessment; surgeons listed indications, and reviewed surgical procedures. Nurses analyzed OR setting and the equipments. Safety personnel elaborated informed consents based on robotics specificity, managers did the costs analysis. Training plans and formal educational session have been developed through literature analysis. The group scheduled periodical meetings to discuss solutions, provide protocols and share decisions. The production of protocols for each procedure were written or modified after discussion.

**Results and Conclusions:** The multi-professional approach allowed us to contend with robotic surgery's challenges with special concern on safety. Surgical tutoring was not needed in the gynecology group and only one patient received laparotomy in the first 35 cases. We did not observe any major complications in our series.

## 9 Para-aortic lymphadenectomy: Role of robotic surgery, a prospective study

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**Objective:** The aim of this study is to compare robot-assisted laparoscopy para-aortic lymphadenectomy (extra- or trans-peritoneal) to conventional laparoscopy in an experimented team.

**Methods:** Data was prospectively collected from May 2008 to January 2012. We compared 23 patients operated on with the da Vinci<sup>®</sup> Surgical System with 55 patients operated in the mean time using conventional laparoscopy. We studied surgical time, lymph node yield, occurrence of an hemorrhagic event, length of stay and post-operative complications.

**Results:** There was no statistical difference between the two groups in terms of age, BMI and cancer type. Compared to conventional laparoscopy, robotic surgery had comparable operative time (218 vs. 250 min, not significant [NS]) and lymph node yield (21 vs. 21, NS). Length of stay was significantly higher for patient operated by robot-assisted laparoscopy (4.3 vs. 3.5 days,  $p = 0.001$ ).

**Conclusions:** Robot-assisted para-aortic lymphadenectomy is technically feasible in our study. Nonetheless, we need a prospective study comparing conventional laparoscopy and robotic surgery to confirm this tendency and have reliable information on blood loss and

complications. The ongoing ROBOGYN protocol should give us such answers and help surgeons to choose between the two techniques.

## 10 Colpoteres suspension procedure: An alternative to sacrocolpopexy for repair of pelvic floor prolapse

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**Purpose:** To determine if there is a viable alternative to sacrocolpopexy as the “Gold Standard” surgical procedure to correct symptomatic pelvic floor prolapse?

**Scope:** Robotic-assisted laparoscopic surgery using any model of the da Vinci<sup>®</sup> by Intuitive Surgical, Inc.

**Methods:** The round ligaments of the uterus are attached to the angles of the neovaginal apex or the cervical stump. A synthetic non-absorbable mesh is “sandwiched” between two layers fetal bovine/porcine integument, which is then incorporated into the suspension for permanency.

**Results:** In a series of 75 women who underwent the procedure, pelvic organ prolapsed was restored from a POP-Q Score of 3–4 pre-operatively, to 0–1 post-operatively, with no recurrence after 6-weeks and 6-months.

**Conclusion:** In the short-term, the “MSN” procedure is proven to be a competitive and viable alternative to sacrocolpopexy.

## 11 Robotic sacrocolpopexy for reconstruction of total pelvic floor defect using a modified “Y” shape mesh: Functional outcomes

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**Objective:** To prospectively evaluate robotic sacrocolpopexy (RSCP) for complete pelvic floor defect and assess the feasibility and safety of our technique.

**Materials:** From 2009 to 2011, 78 patients underwent RSCP using a modified hand made Y soft polypropylene mesh usually inserted after subtotal hysterectomy for pelvic floor defect with prolapse classified minimum stage 3 (Villet classification) in our institution. Pre-operative and post-operative data including pain and functional outcomes as assessed by clinical exam and PFDI-20 and PFDI-7 score are presented.

**Results:** Mean age was 64 years and body mass index was 23 kg/m<sup>2</sup>. Only 3 (5 %) patients had a previous surgery for a genital prolapse. Mean operating time, blood loss, and hospital-stay were respectively: 120 min (range 90–180), 150 ml (60–400) and 3½ days. No peri-operative complication, probably because of our laparoscopic learning curve for this technique. Post-operative complications included nausea and asthenia. One patient suffered from ovarian torsion and needed surgery. No recurrence at 12 months; however, 8 (11.9 %) patients presented with urinary incontinence. Anatomical overall objective cure rate was observed in 65 (96 %) patients. With a median

follow-up is 12 months (range 1–36), the overall anatomic repair reached 98 % and both PFDI-20 and PFDI-7 showed improved results in a statistically significant way (0.01).

**Conclusions:** RSCP with our Y modified mesh is safe and effective and allows the repair of complete floor reconstruction including in case of lateral defect.

## 12 Tubal anastomosis by robotic-assisted laparoscopy: First case in public hospital in Latin America

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**Background:** In Venezuela, there are three unit systems of robot da Vinci<sup>®</sup>. Two of them are located in private hospitals as well as in the rest of Latin America. Clinic University Hospital of Caracas is the only public hospital in Latin America which has this system. The introduction of da Vinci<sup>®</sup> robotic surgery to the field of gynecology has resulted in large changes in surgical management. In general gynecology and reproductive gynecology, the robot is being increasingly used for several procedures. Laparoscopic surgical tubal anastomosis is an alternative for microsurgical anastomosis to reverse sterilization in women with renewed child wish.

**Case Report:** A 38-year-old woman, gravida 2, para 1, cesarean I with diagnosis second primary infertility junction, consistent with previous tubal ligation, patient requested reversal tubal ligation. Hysterosalpingo contrast sonography reports bilateral tubal obstruction was performed diagnostic laparoscopic with 5 mm optica. Full robotic assistance was used to anastomose the tube with da Vinci<sup>®</sup> system used 4 points technique. A chromotubation test showed anastomotic patency without leak. The patient recovered uneventfully after surgery and was discharged within 24 h after the procedure. Robotic-assisted laparoscopy was successful for tubal anastomosis.

**Conclusion:** Tubal reconstructive laparoscopic surgery can be a good alternative for tubal anastomosis in infertile patients with tubal ligation with renewed child wish.

## 13 Robotic vs. conventional laparoscopy approach for infra-renal trans-peritoneal para-aortic lymphadenectomy

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**Objective:** To analyze the outcomes and cost of two surgical approaches to perform the infra-renal trans-peritoneal para-aortic lymphadenectomy in gynecological malignances.

**Methods:** We studied 38 patients diagnosed of gynecological cancers from a single institution, 20 patients were operated by robotic and 18 by conventional laparoscopy. We analyzed the peri- and post-operatives outcomes, and the cost/benefit of the two surgical approaches.



**Results:** Both groups were homogeneous in age, BMI, Score of the American Society of Anesthesiologists, pre-surgical hemoglobin and type of gynecological cancer. The mean of para-aortic nodes removed were higher in robotic group ( $11.2 \pm 7.1$ ) compared to laparoscopy group ( $8.2 \pm 4.6$ ), but differences were not statistically significant. Operative time of the procedure was shorter in the robotic group as compared with laparoscopy ( $80.0 \pm 25.2$  vs.  $114.4 \pm 22.2$  min;  $p = 0.001$ ). The estimated blood loss was lower in the robotic group relative to the laparoscopy group ( $63.1 \pm 49.3$  vs.  $101.8 \pm 43.1$  ml;  $p = 0.052$ ), but not the transfusion rate. There were not statistical differences between the groups in respect to the length of hospital stay and pre- or post-surgical complications. The estimated cost were higher in robotic group compared with laparoscopy in relation to surgery ( $p = 0.001$ ), but relative to the hospitalization and the global cost were not statically different ( $p > 0.05$ ).

**Conclusions:** Robotic-assisted surgery had a shorter operative time and lower blood loss as compared to laparoscopy in the infra-renal trans-peritoneal para-aortic lymphadenectomy. Robotic is more expensive in relation with the surgical procedure, but not in hospitalization or global cost.

#### 14 Robotic extra-peritoneal para-aortic lymphadenectomy in a locally advanced cervical cancer case

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**Objectives:** To report robotic extra-peritoneal para-aortic lymphadenectomy (PAL) procedure in a patient with stage IIB, locally advanced cervical cancer (LACC), performed in our tertiary center as a first experience in Turkey.

**Methods:** A 38-year-old woman referred to us with a biopsy proven diagnosis of squamous cell cervical carcinoma. She was realized as LACC (stage IIB) after a gynecologic examination under anesthesia. Cystoscopy revealed no involvement of bladder. Pre-operative MRI and PET-CT imaging results revealed no evidence of disease outside the pelvis. At the initial diagnostic laparoscopy, no evidence of metastasis recorded in the abdominal cavity. A left-side robotic extra-peritoneal PAL procedure was performed according to the principles previously described.

**Results:** The operation was uncomplicated with a total blood loss of 40 ml. Total operation time was 110 min. Complete PAL procedure was performed in the presented case (lymph nodes bearing tissue from the aorta and aorticaval space were completely removed from the left renal vein cranially to common iliac artery bifurcation caudally). Microscopic metastatic carcinoma was detected in 2 out of 16 collected lymph nodes. Her treatment plan was modified to an extended field radiotherapy including the para-aortic lymphatic zone.

**Conclusions:** According to our initial experience, the use of da Vinci<sup>®</sup> robotic system for extra-peritoneal PAL procedure seems to be a safe and effective procedure with a short learning curve for gynecologic oncologists. The oncological outcomes and cost-effectiveness of this new robotic surgical indication needs to be verified prospectively in larger series.

#### 15 Belgian experience of robot assisted laparoscopic para-aortic lymphadenectomy for staging of locally advanced cervical carcinoma: A multicentric study

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**Objectives:** FIGO clinical staging, imaging techniques may underestimate extension of locally advanced cervical cancer (LACC). The presence of para-aortic lymph node (LN) metastasis in LACC identifies patients with poor prognosis. Laparoscopic para-aortic lymphadenectomy is now proposed as a diagnostic tool. Feasibility and safety of robot assisted laparoscopic para-aortic lymphadenectomy has been reported. We collected data from different Belgian centers to assess its oncological safety and complication rate.

**Methods:** Three centers participated in the study. Thirty-seven patients with LACC underwent a pre-treatment robot assisted laparoscopic para-aortic lymphadenectomy. Data was prospectively collected.

**Results:** The median number of LN collected was 27.5 (range 1–54) per patient. Five out of 37 patients had para-aortic node metastasis. The false negative rate for PET CT diagnosing para-aortic node metastasis was in 10.8 % (4/37) cases. We encountered two (5.4 %) major intra-operative complications. Post-operative morbidity was low (13.5 %). Median follow-up time was 27 months (95 % CI 24–30). Median disease-free survival (DFS) was 16 months (95 % CI 2.4–29.6). Patients with negative LN had a median DFS of 24 months (NA) although patients with positive LN had a median DFS of 9 months (95 % CI 6.9–11.9).

**Conclusions:** In this series, we report that robot assisted laparoscopic para-aortic lymphadenectomy provided the surgeon with useful information to avoid under-staging in 10.8 % of women with LACC, at the expense of low morbidity (13.5 %). Presence of microscopic para-aortic LN metastasis is correlated with shorter DFS. The number of patients with positive LN does not allow us to draw any firm conclusion.

#### 16 Learning curve in robotic surgery

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**Objective:** To study the learning curve in robotic surgery.

**Methods:** Retrospective case analysis of minor procedures (MIP) and major procedures (MAP) from July 2009 up to March 2012 performed by four consultants in a district general hospital.

**Results:** The median age was 44 years (range 25–70). Twenty-nine patients had a body mass index (BMI: 20–25), 22 (BMI: 25–30), 12 (BMI: 30–35), 6 (BMI: 35–40), 2 (BMI: 40–45), and 1 (BMI: 50–55)



kg/m<sup>2</sup>. Sixteen cases had MIP (BSO/ovarian cystectomy/endometriotic nodule excision) and 56 had MAP (TH/sacrocolpopexy/myomectomy). The median preparation time was 60 min (range 35–75) and median positioning time was 37.5 min (range 20–60). The median console time for MIP was 87.5 min (range 29–195), whilst for MAP was 142.5 min (range 60–335). The median anaesthetic time for MIP was 185 min (range 84–300) and for MAP was 240 (range 135–420). Seventy patients had blood loss of <150 ml and two patients had a blood loss of 1 and 2 liters, respectively, because of dense adhesions. One patient who had an intra-operative retroperitoneal haematoma, two had wound haematomas and one had bleeding per vaginum. Robotic surgery was abandoned in one patient due for BSO because of dense adhesions and bleeding of one liter. Two patients who had TH (robotic-assisted hysterectomy) + BSO (bilateral salpingo-oophorectomy) returned back to hospital with abdominal pains and abdominal wound haematoma.

**Conclusion:** The preparation, docking, console and anaesthetic time reduced from 2009 to date in minor procedures but there was a gradual decline in major procedures because of case complexities in 2011 and 2012.

## 17 Case studies of robotic hysterectomy

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**Objective:** To evaluate retrospective case studies of robotic hysterectomy.

**Methods:** Retrospective case analysis of 50 robotic-assisted hysterectomy (RAH) ± bilateral salpingo-oophorectomy (BSO) patients from July 2009 to March 2012 performed by four consultants.

**Results:** The median age was 45 years (range 28–69). Twenty patients had a body mass index (BMI: 20–25), 17 (BMI: 25–30), 7 (BMI: 30–35), four (BMI: 35–40), one (BMI: 40–45), and one (BMI: 50–55) kg/m<sup>2</sup>. Thirty-seven patients had a RAH + BSO (eight had lymph node sampling for stage Ia endometrial cancer) and 13 had RAH only. Two patients were for endometrial hyperplasia, one each for persistent CIN-3 and stage Ia carcinoma of cervix, eight for endometrial cancer, nine for fibroids, 18 for HMB and 11 for severe endometriosis. The median preparation time was 60 min (range 35–75) and median positioning time was 34 min (range 20–60). The median console time was 136.5 min (range 60–335) whilst the median anaesthetic time was 240 min (range 135–535). Twenty-four patients were caesarean sections. Forty-nine patients had blood loss of <150 ml and one had a blood loss of 1 liter (dense adhesions). Forty-three patients and seven patients had mild and moderate pain scores respectively (VAS). One patient each had an intra-operative retroperitoneal haematoma (verres needle) and intra-abdominal-bleeding (adhesions). Forty-eight patient shad 11-day and two patients had a 5-day hospital stay (severe abdominal pains and haematoma). Two patients returned back to hospital with abdominal pains and wound haematoma.

**Conclusion:** With increasing confidence and good laparoscopic skills, the console and anaesthetic times, intra- and post-operative complication rates, blood loss and hospital stay have decreased.

## 18 Learning curve in robotic sacrocolpopexy

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**Objective:** To evaluate retrospective case studies of robotic sacrocolpopexy.

**Methods:** Retrospective case study of three cases of sacrocolpopexy from January 2010 to December 2011 performed by the same consultant in a district general hospital.

**Results:** The median age was 57 years (range 48–64). One patient had a body mass index (BMI) between 25 and 30 kg/m<sup>2</sup> and two patients had a BMI of 30–35 kg/m<sup>2</sup>. All three cases were menopausal while two were smokers and two were sexually active. One patient had previous LAVH and the other two had VH (vaginal hysterectomy). All three patients had use of 3 robotic arms and an accessory port for manipulation. Ethibond interrupted sutures was used for placement of synthetic non-absorbable mesh over the vaginal area. Helical tack fixation device was used to anchor mesh to the sacrum. The peritoneum over the sacrum was closed by continuous unibarbed synthetic polyester suture material. The median preparation time was 45 min (range 40–50) and median positioning time was 55 min (range 50–60). The median console time was 180 min (range 154–210). The median anaesthetic time was 300 min (range 254–350). All the patients had blood loss of <100 ml. No patients had intra- or post-operative complications and none returned back to hospital.

**Conclusions:** With a standardized approach, assistance of a clinical fellow and an experienced robotic surgeon the results have been good. Post-operative follow-ups have been excellent in terms of quality-of-life, sexual satisfaction and POP-Q scoring. There have been no cases of mesh erosion or vault prolapse.

## 19 Robotic-assisted radical trachelectomy without vaginal approach: About one case

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**Background:** The development of robotic technology has facilitated the application of minimally invasive techniques for complex operations in gynecologic oncology. We present one case of robot-assisted radical trachelectomy in stage IB1 cervical cancer without vaginal approach.

**Case and surgical technique:** A 39-year woman had a conisation for a cervical intra-epithelial neoplasia type 3: the histology showed a squamous epithelial carcinoma with vertical invasion 13 mm, safe endocervical margin. SCC and pelvic MRI were normal. PET-scan showed a positive latero-aortic lymph node: The patient underwent a coelioscopic retroperitoneal and pelvic lymphadenectomy with 66 negative nodes. A robot-assisted radical trachelectomy was performed using the three arm da Vinci<sup>®</sup> robot exclusively with an assistant trocar and a uterine manipulator. Sparing the

infundibulopelvic and round ligament, the bladder was dissected in the midline and the uterine arteries were isolated at their lateral origins after bilateral ureters' dissection. The posterior blades of the broad ligaments were divided to the sacrouterine ligaments following to the ureters. The parametria were dissected sparing the main branches of the uterine arteries. The ureters were retracted laterally to dissect and divide the anterior ligament, the lower parametrium and the paracolpium. The lateral parts of the sacrouterine ligaments were retracted laterally together with identified fibres of the ileohypogastric nerves. The descending branches of the uterine arteries were controlled by bipolar coagulation. Then, the cervix and the vagina were trans-sectioned using monopolar diathermia. The specimen was removed vaginally with the remaining uterus attached to the adnexae, round ligaments and the intact uterine arteries. A permanent cervical cerclage with mersuture 5 mm was placed into the isthmus. Then, the vagina was sutured to the isthmus by running suture with V-Loc 3/0.

**Results:** Blood loss was 150 ml and time of surgery (console time) was 315 min. The patient stayed in hospital 7-days. No intra-operative complications occurred. She reported normal menstruations. The final pathological examination found 2 mm micro-invasive carcinoma with safe surgical margins.

**Conclusions:** Robotic systems retain the advantages of conventional laparoscopy while offering three-dimensional views, tremor filtration, improved dexterity and less operator fatigue. Robotic technology appears to facilitate the surgical approach for technically challenging operations as the radical trachelectomy.

## 20 Robotic hysterectomy and fistula repair for utero vesical fistula in an elderly patient

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**Background:** Utero vesical (UV) fistulas, though uncommon, are usually related to caesarean sections. Usual symptoms are cyclical menouria and urinary incontinence. The various tests to investigate UV fistulas may include a cystoscopy, a retrograde cystography, methylene blue test and a computed tomography scan.

**Case:** Our patient was a 65-year old lady who had undergone caesarean section surgery three times. After her last caesarean section, she started having cyclical menouria. She did not seek treatment for the same and attained menopause. After 12-years of menopause, she started having recurrent urinary infections and vaginal discharge for which she was evaluated and diagnosed to have a UV fistula. Ultrasonography and CT urography helped in delineating the exact anatomical location of the fistula. She underwent hysteroscopy and cystoscopy with ureteral catheterization followed by robotic hysterectomy with bilateral salpingo-oophorectomy and fistula repair with interposition of omentum.

**Result:** Check cystogram done in post-operative period was normal and patient is asymptomatic at one-year since surgery.

**Conclusion:** Robot-assisted surgery is a good and effective option for repairing the UV fistulas.

## 21 Robotic staging procedure for fallopian tube cancer: Case report

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**Objectives:** Lymphoepithelioma-like carcinoma (LELC) is an aggressive EBV-associated neoplasm, which is commonly reported in the nasopharyngeal region, occasionally in the other organs. LELC is a rare pathology in the gynecologic region. The aim of this case report is to describe first LELC of the fallopian tube and to report staging procedure by robotic surgery.

**Methods:** A 66-year old woman referred with a thin needle aspiration biopsy of inguinal lymph node proven adenocarcinoma with unknown origin, treated with 6 cure chemotherapy. After chemotherapy, right adnexial 4 × 4 cm mass including solid components was detected on pelvic ultrasonography, CA-125 level was 73 U/ml. At the diagnostic laparoscopy, we confirmed adnexial mass originated from right tuba. Then, bilateral salpingo-oophorectomy was performed. Pathologic examination revealed in differentiated LELC of right fallopian tube.

**Results:** Robotic surgical staging procedure (robotic hysterectomy and pelvic para-aortic lymphadenectomy) was performed. The operation was uncomplicated with a total blood loss of 60 ml. Total operation time was 250 min. No microscopic metastatic carcinoma was detected in all specimens, including left tuba, both ovaries, uterus, and 16 pelvic and 15 para-aortic lymph nodes. EBV was not detected by polymerase chain reaction.

**Conclusions:** Primer LELC is very rare in gynecologic malignancy. To our knowledge, this is the first case of the fallopian tube LELC. Also, this is first LELC of the fallopian tube which is treated by robotic surgery. According to our initial experience, the use of da Vinci<sup>®</sup> robotic system for staging surgery procedure seems to be a safe and effective procedure.

## 22 Robot-assisted, laparoscopic, and abdominal myomectomy

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**Objective:** To compare surgical outcomes of myomectomy by laparotomic, laparoscopic and robot-assisted methods.

**Methods:** From 11/01/2004 to 15/03/2012, 105 patients with uterine myoma, myomectomy were performed. From a total of them 32 were laparotomy (Group I), 49 were laparoscopy (Group II) and 24 were robot-assisted (Group III). All patients were representative of this study.

**Results:** Higher blood loss was reported in the abdominal group compared with Group III, with a median of 326.6 ± 55.9, 197.7 ± 24.5 and 260.4 ± 46.9 mL in the abdominal, laparoscopic and robot-assisted groups, respectively ( $p < 0.05$  between Groups I and III, and  $p > 0.05$  between Groups I, II and II, III). The actual surgical time was 125.2 ± 8.3 min in the abdominal group,

132.6 ± 8.7 in the laparoscopic group, and 240.4 ± 22.4 in robot-assisted group ( $p < 0.05$ ). Early post-operative complications: three supuration of post-operative suture in the abdominal group. There were no complications in the Groups II and III. Patients in the abdominal group had a higher median length of hospital stay of 7.6 ± 0.2 days, compared with 5.4 ± 0.2 day in the laparoscopic group, and 4.8 ± 0.1 days in the robot-assisted group ( $p < 0.05$ ). The pregnancy rate at patients undergoing abdominal, laparoscopic and robot-assisted myomectomy was 40.7, 48.5 and 36.4 % respectively. The pregnancy rate in robot-assisted group was significantly different from the laparoscopic group ( $p < 0.05$ ) and did not differ from the laparotomy group ( $p > 0.05$ ). But we can not objectively compare these results at this point in time because of the short period after surgery in the robot-assisted group. Currently, research is underway in this regard.

**Conclusion:** Preliminary data indicate a high efficacy of robot-assisted myomectomy.

### 23 The comparison of effectiveness simple hysterectomy by abdominal, laparoscopic and robot-assistant accesses

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**Objective:** Our goal was to evaluate the effectiveness of a simple hysterectomy by various surgical accesses and analyze the results.

**Methods:** From 10/01/2007 to 31/12/2011 in Clinic of Women's Diseases National Medical Surgical Center named NI Pirogov. We observed 193 women with fibroid uterus: abdominal hysterectomy (AH = 30), laparoscopic hysterectomy (LH = 30), robot-assistant hysterectomy (RAH = 33). All the patients were represented in this report. We evaluated time from "skin-to-skin", console time, general blood loss, intra-operative and early post-operative complications, and recovery time of patients after surgery.

**Results:** Duration of the surgery ("from skin-to-skin") was 120 ± 10 min in AH, 100 ± 4 min in LH, 150 ± 20 min in RAH ( $p < 0.05$ ). Time while the surgeon at the console (the time of the operation itself) in the RAH was 120 ± 2 min. The minimum of blood loss in RAH was 97.5 ± 5.2 ml (AH = 195 ± 20.8 ml, and in the LH = 127.7 ± 8.6 ml [ $p < 0.05$ ]). Intra-operative complications took place in the LH: one case of ureteral injury, one of bladder. In the RAH, there was a conversion due to the large size of fibroid uterus (18 weeks). In one patient with AH, there was injury of the intestine (adhesions after two caesarean sections in history). The minimum hospitalization and rapid recovery of the total state were in the group RAH.

**Conclusions:** RAH is comparable to traditional laparoscopy, which is evidenced by the lack of statistically significant differences between the two accesses. For efficiency, they are identical and significantly superior to laparotomic access. Robot-assisted laparoscopy is a promising surgical treatment for fibroid uterus.

### 24 Physiological changes during robotically assisted gynecological oncology surgery

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**Background:** Physiological changes during steep Trendelenberg and pneumoperitoneum are documented in urological and colorectal surgery. Robotic surgery (RS) in gynecological oncology is increasing in popularity; however, data paucity on physiological changes exists. Herein, physiological anaesthetic data from 21 consecutive cases during RS is presented.

**Methods:** Standard intra-operative monitoring data included: cardio-respiratory parameters, arterial blood gas, oesophageal doppler cardiac output (CO) monitoring collected at specified points during surgery.

**Results:** Average mean arterial pressure (MAP) fell by 17.9 % after pneumoperitoneum rose by 45 % on assumption of Trendelenberg and gradually fell progressively throughout the procedure to 8.6 % below baseline after release of pneumoperitoneum. Mean CO fell by 40 % after pneumoperitoneum and rose by 15 % on assumption of Trendelenberg. End Tidal carbon dioxide (ETCO<sub>2</sub>) rose by 17.1 % after pneumoperitoneum and a further 7.8 % on assumption of Trendelenberg. Arterial CO<sub>2</sub> (PaCO<sub>2</sub>) rose by 21.9 % after pneumoperitoneum, remaining unchanged throughout the procedure. Arterial oxygenation fell by 14.4 % after pneumoperitoneum falling by further 3.8 % on assumption of Trendelenberg. However, mean haemoglobin-oxygen saturations remained 97 % throughout. Mean airway pressures increased by 51.7 % after initial peritoneal insufflation continuing to rise throughout the procedure, falling on release of pneumoperitoneum.

**Conclusions:** Our observed physiological changes reflect current literature during robotically assisted prostatectomy (similar degrees of Trendelenberg and pneumoperitoneal pressures used). Oxygenation is compromised on pneumoperitoneum and further by assumption of the Trendelenberg position; however, these changes do not appear to translate into a reduction in haemoglobin oxygen saturations. In this small group, pneumoperitoneum and the Trendelenberg position appear well tolerated in terms of cardio-respiratory homeostasis.

### 25 Does patient age restrict the practice of robotic surgery in gynecological oncology?

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**Background:** The role of robotic surgery (RS) in gynecological cancers is being explored. Concerns remain about patient ability to tolerate the steep Trendelenberg especially in older women. We report our experience in 42 women over the age of 65 who underwent RS at our institution.

**Methods:** This is a prospective, observational study from a tertiary gynecological oncology centre with two surgeons over 2-years. Patient demographics, intra- and post-operative data recorded. Comorbidities including hypertension, diabetes, cardiac and respiratory status and concurrent medications were recorded. Smoking status was also ascertained at pre-operative assessment.

**Results:** One-hundred-twenty-two cases have been performed overall till date. Forty-two of 122 women were aged over 65 with a mean age of 72 years (range 65–88). The mean BMI was 33 kg/m<sup>2</sup> (range 20–53). Two of 42 women smoked more than 10 cigarettes per day. Four of 42 cases were diabetic on oral hypoglycemics. Seventeen of 42 cases were on antihypertensives. Two of 42 women were on warfarin for atrial fibrillation which was stopped prior to surgery and resumed on day-2 at home. Twenty-two of 42 cases reported dyspnoea on mild exertion and 20/42 reported dyspnoea at rest. At RS, a Trendelenberg up to 28 degrees was adopted throughout the procedure.

Mean blood loss at surgery was estimated at 60 ml (range 5–250), and mean hospital stay was 1-day (range 1–8).

**Conclusions:** RS appears to be well tolerated in women over 65. Medical co-morbidities did not appear to significantly change our approach to surgery. The biggest advantage to patients is the reduced blood loss, shortened hospital stay, and reduced post-operative pain.

## 26 Robotics in gynecological oncology: The Guildford experience

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**Background:** Application of minimally invasive surgery in gynecological oncology was reported since 1980s. Uptake of laparoscopic surgery among gynecologists has been poor with only a 14 % reduction in open surgery. The rate-limiting step appears to be advanced laparoscopic skills required for complex gyn-onc surgery, which appears less widespread. We report our experience of robotic surgery (RS) in endometrial cancer (EC), cervical cancer (CC) and ovarian cancer (OC).

**Methods:** This is a prospective, observational study in a tertiary gynecological oncology centre with two surgeons over 2-years. Patient demographics, intra and post-operative data are recorded.

**Results:** One-hundred-thirty-two cases were performed. The case-mix included (39) CC, (79) EC, (10) OC, and four benign causes. Mean BMI was 33 kg/m<sup>2</sup> (range 17–59). Median estimated blood loss overall was 50 ml (range 5–2,500). Median hospital stay was 1-day. Lymph node yield was comparable (0–56).

**Conclusions:** Our experience suggests that RS certainly has a role in gynecological oncology due to precise, accurate surgery. Initial set-up and maintenance costs are expensive; however, ongoing costs are comparable with laparoscopic surgery. The biggest advantage to patients is the reduced blood loss, shortened hospital stay, reduced post-operative pain due to less torque on trocars and varied applications even in gyn-onc surgery. Camera positioning by the surgeon, no camera shake, 3D image leading to greater appreciation of surgical anatomy along with better ergonomics and less fatigue are benefits to surgeons.

## 27 Robotic surgery at “low volume” hospital: Can it be justified?

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**Background:** Demand and utilization of minimally invasive procedures in gynecological surgery have increased in recent years. However, comparative studies regarding costs as well as benefits for the patient using robotic surgery are sparse. The aim of this study was to compare total abdominal hysterectomy (TAH) with total robotic hysterectomy (TRH) performed in a Swedish community hospital, with a case load of approximately 170 robotic procedures annually.

**Methods:** We conducted a retrospective review during the period October 2010 and December 2011. During this time period, 116 consecutive patients underwent hysterectomy (TRH n = 50, TAH

n = 66). Operation time, hospital stay, complication rate (Clavien-Dindo Classification) and direct and component costs were recorded. **Results:** There were no significant differences in patient characteristics between the two groups. The median operation time for TRH was 102 min (range 63–184) and for TAH it was 90 min (range 50–179). In the median operation time was also included the learning curve for two younger surgeons who started performing robotic hysterectomies during the study period. The median time to start up the procedure was 50 min (range 34–88) for TRH and 63 min (range 21–95) for TAH. Blood loss during operation was 68 ml for TRH and 245 ml for TAH. Post-operative complication rate in TRH was 4 % (grad I) and 16.6 % in TAH (7.6 % grade I, 4.5 % grade II, 4.5 % grade IIb) according to Clavien-Dindo classification. The mean length of hospital stay was 2-days for TRH and 4.6-days for TAH. Direct cost for TRH was €3,805 and €5,280 for TAH. When considering the purchase and maintenance costs for the robot, the financial burden would increase by €3,091 per patient, given an average of 200 cases per year.

**Conclusions:** Robotic hysterectomy is superior to abdominal hysterectomy with respect to hospital stay, blood loss and complication rate. TRH is associated with higher cost, predominantly due to high robot costs for purchase, maintenance and operative equipment, overshadowing savings gained by the shorter length of stay. Even at a relative low volume hospital, TRH can be performed with lower complication rate compared to TAH.

## 28 Cost analysis of robotic total laparoscopic hysterectomy

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**Background:** Robotics surgery has many advantages but cost is still the main limit for the diffusion and the utilization of this kind of technology. The objective of this study was to analyze, for an existing robot model, the feasibility of reducing the costs in case of robotics surgery for endometrial cancer.

**Methods:** Twenty-two endometrial cancer patients undergoing robotic surgery in the Centro Oncologico Fiorentino were enrolled in the study from June 2010 to April 2012. Data on patients and tumour's characteristics, kind of surgery, operative times, complications, conversion and costs related to operating room (OR), hospital, laboratory and pharmacy fees were prospectively recorded in a computed database. Surgeries were divided in two different robotics approaches (A: standard, and B: modified) in relations to numbers of operative robotic arms, OR staff composition (nurses, non-nurses, surgeons and anaesthetists), disposable and non-disposable instruments. Comparison of costs and feasibility between the two groups was performed.

**Results:** Eight patients were treated following the standard robotics approach (A) with 4 robotic arms and 14 women with the modified approach (B) with 3 robotic arms, reduction of disposable laparoscopic instrumentation and OR staff. Pelvic lymphadenectomy was performed in 14 cases (5 in group A and 9 in group B). Median operative time in group A was 214 min (range 157–265), and in group B it was 185 min (range 126–219). No intra-operative or post-operative major complications occurred in both groups. Median hospital costs per intervention (excluding robotic surgical system cost) were in group A: €8,858 and in group B: €7,244 with a reduction of 18 %.

**Conclusion:** Even if the most significant cost incurred by a hospital with robotic surgery is the initial purchase and the maintenance for



the robotic surgical system that can be ameliorated only by increased number of cases performed; the present study demonstrate the possibility of further reducing costs of the single interventions thanks to a modified robotic approach.

## 29 Robotic single port total laparoscopic hysterectomy: Preliminary experience

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**Objective:** To report a technique that performed single access robotic laparoscopy for endometrial cancer treatment.

**Methods:** Four patients with diagnosis of endometrial adenocarcinoma G1 and instrumental FIGO stage IA or IB underwent single access robotic laparoscopic extra-fascial hysterectomy and bilateral salpingo-oophorectomy. Procedure was performed through a single trans-umbilical incision of 35 mm using da Vinci<sup>®</sup> Robotic S System and Gelpoint device with one 12-mm trocar for robotic 3D optic, two 8 mm and one 5 mm trocars. Surgeries followed the classic laparoscopic technique using 0 degree robotic camera, EndoWrist bipolar forceps, monopolar scissor, needle holder and laparoscopic suction irrigation and grasper. Vaginal cuff was repaired with an intra-corporeal suture using a barbed wound closure system.

**Results:** All surgical procedures were successful. Two G1 endometrial cancer FIGO stage IA and IB were treated. Median BMI was 25.6 kg/m<sup>2</sup> (range 22–29.3), total operative time 218 min (range 176–250), docking time 14 min (range 11–17), and blood loss 50 mL (range 10–90). No cases required multiple abdominal access or conversion to laparoscopy or laparotomy. No intra- or post-operative complications occurred. All patients were discharged on day-two.

**Conclusions:** Robotic single-port trans-umbilical total hysterectomy is technically feasible and reproducible in patients with low-stage endometrial cancer. Additional studies are needed to demonstrate benefits of this technique.

## 30 The learning curve for robotic-assisted benign gynecologic surgery: Sixteen procedures to optimize the OR team efficiency and surgeon's skills

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**Objective:** To determine the number of cases needed to optimize the learning curve for the operating room team as well as surgeon when using the da Vinci<sup>®</sup> Surgical System to perform benign gynecological procedures.

**Methods:** Operating room data was entered prospectively for all patients undergoing a benign gynecological procedure via robotic surgery over a time period of 26-months. Data points included total times for patient preparation, instrument docking, port placement,

console time, operating time, room time, and estimated blood loss. The patient preparation and docking times of all 188 cases were used to evaluate the OR team's learning curve. A subset of 34 hysterectomies performed by a single surgeon was analyzed to establish the surgeon's learning curve. Statistical significance was measured by the Wilcoxon Rank Sum Test.

**Results:** Sixteen cases represented a statistically significant reduction in times and estimated blood loss and constituted the point after which improvement plateaued. The OR team's learning curve stabilized at a patient preparation time of 20 min and a docking time of four min. The surgeon's learning curve leveled at a total operative time of 130 min and total console time of 75 min.

**Conclusions:** Robotic-assisted surgery for benign gynecological procedures is a practical application for the general OB/GYN practitioner and their trained OR staff with a short learning curve of 16 cases. Given the adaptability of this technique, gynecologists could easily be trained to provide minimally invasive surgery with potentially decreased blood loss and shorter hospital stay.

## 31 Robotic radical hysterectomy in early-stage cervical carcinoma patients, comparing results with laparoscopically-assisted radical vaginal hysterectomy cases

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**Objective:** To compare intra-operative, pathologic and post-operative outcomes of robotic radical hysterectomy (RRH) to laparoscopically-assisted radical vaginal hysterectomy (LARVH) in patients with early-stage cervical carcinoma.

**Methods:** The first 20 patients with cervical cancer stages IA2-IIA underwent RRH and were compared with previous 20 LARVH cases. The procedures were performed at University Hospital Olomouc, Czech Republic, between 2004 and 2011 by two surgeons (P.R., D.P.).

**Results:** There were no differences between groups for age, body mass index, tumor histology, stage, lymphovascular space involvement or nodal status. No statistical differences were observed regarding operative time (265.4 vs. 295.2 min). The mean (SD) estimated blood loss (EBL) was 143.3 ml in RRH group and 352.5 ml in LARVH. This difference was statistically significant in favor of RRH group ( $p = 0.0001$ ). Mean length of stay was significantly shorter for the RRH group (7.2 vs. 8.6 days,  $p = 0.02$ ). Mean pelvic lymph node count was similar in the two groups (20 vs. 21). None of the robotic or laparoscopic procedures required conversion to laparotomy. The differences in major operative and post-operative complications between the two groups were not significant.

**Conclusions:** Based on our experience, robotic radical hysterectomy showed better results than traditional laparoscopically-assisted radical vaginal hysterectomy in early-stage cervical carcinoma cases. We feel the intuitive nature of the robotic approach, even during the learning curve, combined with significant reduction in surgeon's fatigue offered by the robotic system will allow more surgeons to use a minimally invasive approach to radical hysterectomy. [This study was supported by IGA MZ CR grant NT 13566-4/2012].



### 32 Single institution experience on robot-assisted gynecologic surgery

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**Background:** The minimally invasive techniques in gynecologic surgery have found a growing application. The recent introduction of robotic technology has increased the potentiality of minimal invasive technique leading to an expansion of indications and applications, particularly for the management of malignant diseases. We reviewed our experience in robot-assisted surgery of benign and malignant gynecologic diseases.

**Methods:** Between October 2008 and March 2012, 278 patients underwent robot-assisted surgery using the da Vinci® S Robotic System for several gynecologic diseases. There were 69 (25 %) surgical operations for malign conditions and 206 (75 %) for benign diseases. We are the first team in Turkey performing robotic surgery. All the procedures were performed by a single surgeon (AG).

**Results:** Patients demographics and operative data are given below in the table. There was no surgical mortality. The other operations not specified in the table below were as following: 12 robotic-assisted tuboplasty, 32 robotic-assisted surgeries for endometriosis and two robotic-assisted cerclage. The surgical outcomes of these procedures were not given due to the heterogeneity of the operations.

**Conclusions:** Robotic surgery is yet in the early stages even though robotic-assisted surgery is increasing continuously. More randomized-controlled trials studies are warranted to determine if robotic surgery truly offers a benefit over other minimally invasive techniques in terms of surgical outcomes.

### 33 Learning curve for robotic-assisted gynecologic oncology surgery

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**Introduction:** The evolution of minimally invasive surgery to robotic-assisted laparoscopy in gynecologic oncology is a promising technical approach to achieve a higher level of competence for procedures with initially complex learning curve. We aimed to study of the learning curve of two robotic-assisted gynecologic oncology procedures performed by a single surgeon with no previous experience in laparoscopy at the Alexis Vautrin Center in order to assess the effect of increasing surgeon's experience on inter-phases of learning curve.

**Methods:** Retrospective analysis of 73 consecutive procedures was performed between April 2002 and May 2011. The cumulative sum (CUSUM) method was used to analyze the surgeon console time (SCT) and operative time (OT) learning curves for procedures including radical hysterectomy (RH) and RH with pelvic lymphadenectomy (RHPL). The comparison of inter-phases of learning curves was done according to the Wilcoxon test.

**Results:** Twenty-two (30 %) endometrial carcinoma, 26 (36 %) uterine cervix carcinoma, 13 (19 %) high grade cervical neoplasia, 12 (15 %) prophylactic surgeries cases were treated by RH (n = 34) or RHPL (n = 39). RH group: learning curve consisted of two phases (I: initial learning, II: increasing skills) with decrease in OT and SCT from nine procedures ( $p < 0.05$ ) [Fig. 1]. RHPL group: a third phase was identified (III: more complex surgical cases) with decrease in OT

	Age (years)	BMI (kg/m <sup>2</sup> )	OT (min)	CT (min)	Hospital stay	EBL (ml)	
Endometrial cancer staging (n = 46)	57.8 (37–80)	33.2 (19–49.8)	236.6 (157–315)	215.6 (137–290)	2.6 (2–4)	56.6 (10–210)	Mean lymph node count: 42.7 (13–86) Paraortic lymph node: 20.2 (5–39)
Radical hysterectomy (n = 23)	50.8 (37–69)	30.8 (19–40.2)	270.2 (180–355)	228.7 (113–330)	2.4 (2–4)	73 (10–220)	Mean lymph node count: 27.2 (8–36)
Myomectomy (n = 23)	34.8 (25–44)	25.8 (19.1–33.3)	142.2 (83–218)	93.3 (53–163)	1.6 (1–3)	101.3 (50–350)	Mean of removed myomas: 2.4(1–13)
Sacrocolpopexy (n = 7)	64.4 (57–76)	30 (20.5–39.2)	150.5 (114–189)	123.6 (84–166)	2.8 (2–4)	12.5 (10–20)	No recurrence during follow-up
Sacrocolpopexy (n = 7)	37.5 (23–47)	27.6 (18.6–34.4)	146.1 (113–192)	123.1 (97–160)	1.6 (1–3)	32.5 (10–80)	No recurrence during follow-up
Hysterectomy (n = 85)	50.8 (33–72)	30.3 (18.4–46.1)	107.4 (47–235)	81.2 (33–186)	2.2 (1–5)	46.1 (10–125)	No major complication
Tubal reanastomosis (n = 34)	37.4 (31–41)	28.1 (20–36.3)	115.4 (78–164)	101.3 (56–138)	1.5 (1–2)	NS	Intrauterine pregnancy rate 70 % Ectopic pregnancy 1/34

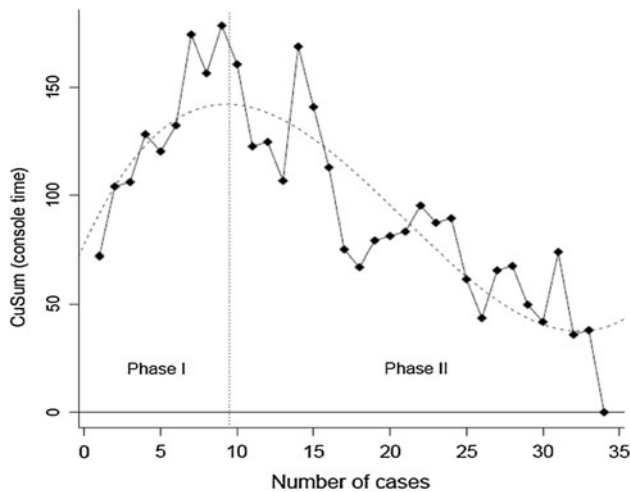


Fig. 1

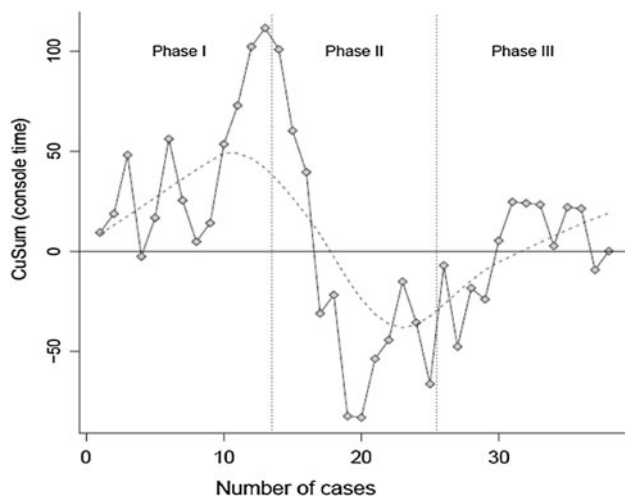


Fig. 2

( $p = 0.05$ ) and SCT (not significant) from 13 procedures [Fig. 2]. Intra-operative complication rate (15 % RH group vs. 3 % RHPL group) was not dependent on operative surgeon experience.

**Conclusions:** Learning curve analysis represents the number of cases needed to reach a satisfactory skill level to perform a surgical technique. Initial learning phase (I) of robotic-assisted surgery seems faster compared to literature on learning conventional laparoscopy. Robot-assisted laparoscopy is a relevant technical approach to conventional laparoscopy for un-initiated surgeons and could be an alternative pathway for young surgeons training using robotic surgical simulators.

## IV. Videos/Techniques/Case Reports

### 1 Complex hysterectomy and role of robotics

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In the United States, one out of three women will undergo a hysterectomy by the age of fifty. Robotics in gynecology has multiple applications, but in cases where patients have had multiple prior laparotomies, this may prove a beneficial tool for improved patient outcomes. Robotics has demonstrated advantages with its ability for three dimensional visualization, endo-wristed capabilities and improved ergonomics for the operating surgeon. We present a case of a 45-year-old female with symptomatic fibroid uterus presenting with severe menorrhagia and anemia. The patient is nulligravid and had two myomectomies performed via laparotomy in the past. Her fibroids and advanced age have contributed to her nulligravity. We proceeded with a robotic-assisted total hysterectomy and the case demonstrates extensive adhesiolysis and enterolysis resulting from her prior surgeries. The procedure was completed robotically and the patient was discharged home within twenty-fours. She subsequently had an uncomplicated post-operative course. This case demonstrates that robotics in gynecology for select patients with advanced complex anatomy and pathology can prove beneficial to recovery and improved patient outcomes.

### 2 Standardization of uterine artery ligation in benign hysterectomy

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Minimal invasive hysterectomy, like any other type of hysterectomy, has associated intraoperative complications. The percentage of complications in laparoscopic and robotic hysterectomy varies widely. Half of the serious complications are entry access bowel and retroperitoneal vascular injuries. Most other complications are urinary tract injuries or intraoperative bleeding. Thorough knowledge of the pelvic anatomy is of utmost importance. Constant vigilance in the identification and location of the ureter is the best method of prevention and early detection of ureteral injury. By opening the retroperitoneum and identifying and following the ureter from the entrance in the pelvis down to the level of the uterine artery, one knows the exact location of the ureter through to the whole procedure. In the same time, the uterine artery is located retroperitoneally and can be clipped at the level of the internal iliac artery. By doing so the risk of having difficulties in controlling bleeding throughout the procedure is minimized. A step-by-step technique is presented as well as the first experience in teaching junior residents to perform the technique.

### 3 Robot assisted laparoscopic abdominal radical trachelectomy for preservation of fertility in early-stage cervical cancer: A step-by-step description of the method

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If strict selection criteria are applied, preservation of fertility is possible for women with early-stage cervical cancer. Usually a maximum tumor diameter of 20 mm is the upper limit and the tumor should be

possible to resect with adequate proximal margins and leave around 10 mm of the cervix. A permanent cerclage is placed.

Worldwide most trachelectomies are performed by a combination of a laparoscopic lymphadenectomy and a vaginal trachelectomy. The first published cases of a robotic abdominal trachelectomy were performed in December 2007 and since then a few more small case

series have been published. Here we describe the robotic surgical technique step-by-step including a nerve sparing dissection and also the use of Near-Infrared Fluorescent (NIR) technique for detection of sentinel lymph nodes and visualization of the parametrial tissue and lymph vessels.

A video with the surgical steps will be shown.

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