LESS IS MORE: A Decade of Surgical Evolution in Gynecologic Oncology

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Objectives:

I. Delineate the disease burden in U.S.

II. Review MIS/SLND in Endom CA

III. Review MIS & NAC->IDS in OVCA

IV. Review SLND in Vulvar CA
PRIMUM NON NOCERE
**Cancer Cases and Deaths 2017***

**Female Cases**
- Breast 252,710
- Lung/Bronchus 105,510
- Colon & rectum 64,010
- **4. UTERUS 61,380**
- Thyroid 42,470
- NHL 32,160
- Melanoma 34,940
- Leukemia 25,840
- Pancreas 25,700
- Kidney 23,380
- **11. OVARY 22,440**

**Female Deaths**
- Lung/Bronchus 71,280
- Breast 40,610
- Colon & rectum 23,110
- Pancreas 20,790
- **5. OVARY 14,080**
- **6. UTERUS 10,920**
- Leukemia 10,200
- Liver & Bile Duct 9,310
- Brain & Nervous System 7,080
- **CERVIX 4,210**

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*Source: Cancer Facts and Figures 2017, American Cancer Society*

ENDOMETRIAL CANCER: 
“Less is more”: 

Reduction in Hysterectomy and Lymphadenectomy Morbidity with Technology (2006-present)
Endometrial Cancer

The Incision:
A Major Contributor to Morbidity
Prevalence of Self-Reported Obesity Among U.S. Adults by State and Territory, BRFSS, 2011

*Sample size <50 or the relative standard error (dividing the standard error by the prevalence) ≥ 30%.
Prevalence of Self-Reported Obesity Among U.S. Adults by State and Territory, BRFSS, 2012

*Sample size <50 or the relative standard error (dividing the standard error by the prevalence) ≥ 30%.
Prevalence of Self-Reported Obesity Among U.S. Adults by State and Territory, BRFSS, 2013

*Sample size <50 or the relative standard error (dividing the standard error by the prevalence) ≥ 30%.
Prevalence\(^\dagger\) of Self-Reported Obesity Among U.S. Adults by State and Territory, BRFSS, 2014

*Sample size <50 or the relative standard error (dividing the standard error by the prevalence) ≥ 30%.*
### Prevalence of Self-Reported Obesity Among U.S. Adults by State and Territory, BRFSS, 2014

<table>
<thead>
<tr>
<th>State</th>
<th>Prevalence</th>
<th>95% Confidence Interval</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alabama</td>
<td>33.5</td>
<td>(32.1, 35.0)</td>
</tr>
<tr>
<td>Alaska</td>
<td>29.7</td>
<td>(27.8, 31.7)</td>
</tr>
<tr>
<td>Arizona</td>
<td>28.9</td>
<td>(27.7, 30.2)</td>
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<tr>
<td>Arkansas</td>
<td>35.9</td>
<td>(33.6, 38.0)</td>
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<tr>
<td>California</td>
<td>24.7</td>
<td>(23.5, 25.9)</td>
</tr>
<tr>
<td>Colorado</td>
<td>21.3</td>
<td>(20.4, 22.2)</td>
</tr>
<tr>
<td>Connecticut</td>
<td>26.3</td>
<td>(24.9, 27.7)</td>
</tr>
<tr>
<td>Delaware</td>
<td>30.7</td>
<td>(28.6, 32.8)</td>
</tr>
<tr>
<td>District of Columbia</td>
<td>21.7</td>
<td>(19.5, 24.0)</td>
</tr>
<tr>
<td>Florida</td>
<td>26.2</td>
<td>(25.0, 27.5)</td>
</tr>
<tr>
<td>Georgia</td>
<td>30.5</td>
<td>(28.9, 32.1)</td>
</tr>
<tr>
<td>Guam</td>
<td>28.0</td>
<td>(28.6, 30.5)</td>
</tr>
<tr>
<td>Hawaii</td>
<td>22.1</td>
<td>(20.7, 23.5)</td>
</tr>
<tr>
<td>Idaho</td>
<td>24.9</td>
<td>(23.0, 26.7)</td>
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<tr>
<td>Illinois</td>
<td>29.3</td>
<td>(27.6, 31.1)</td>
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<tr>
<td>Indiana</td>
<td>32.7</td>
<td>(31.6, 34.0)</td>
</tr>
<tr>
<td>Iowa</td>
<td>30.9</td>
<td>(29.6, 32.3)</td>
</tr>
<tr>
<td>Kansas</td>
<td>31.3</td>
<td>(30.3, 32.2)</td>
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<td>Kentucky</td>
<td>31.6</td>
<td>(30.2, 33.1)</td>
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<tr>
<td>Louisiana</td>
<td>34.9</td>
<td>(33.4, 36.4)</td>
</tr>
<tr>
<td>Maine</td>
<td>28.2</td>
<td>(26.9, 29.5)</td>
</tr>
<tr>
<td>Maryland</td>
<td>29.6</td>
<td>(28.1, 31.1)</td>
</tr>
<tr>
<td>Massachusetts</td>
<td>23.3</td>
<td>(22.3, 24.4)</td>
</tr>
<tr>
<td>Michigan</td>
<td>30.7</td>
<td>(29.4, 32.0)</td>
</tr>
<tr>
<td>Minnesota</td>
<td>27.6</td>
<td>(26.8, 28.5)</td>
</tr>
<tr>
<td>Mississippi</td>
<td>35.5</td>
<td>(33.4, 37.6)</td>
</tr>
</tbody>
</table>

Missouri                | 30.2       | (28.6, 31.9)            |
Montana                 | 26.4       | (24.9, 27.9)            |
Nebraska                | 30.2       | (29.2, 31.3)            |
Nevada                  | 27.7       | (25.4, 30.1)            |
New Hampshire           | 27.4       | (25.8, 29.1)            |
New Jersey              | 26.9       | (25.7, 28.1)            |
New Mexico              | 28.4       | (27.0, 30.0)            |
New York                | 27.0       | (25.6, 28.5)            |
North Carolina          | 29.7       | (28.4, 31.0)            |
North Dakota            | 32.2       | (30.5, 34.0)            |
Ohio                    | 32.6       | (31.2, 34.1)            |
Oklahoma                | 33.0       | (31.7, 34.3)            |
Oregon                  | 27.9       | (26.3, 29.6)            |
Pennsylvania            | 30.2       | (28.9, 31.4)            |
Puerto Rico             | 28.3       | (26.8, 29.8)            |
Rhode Island            | 27.0       | (25.4, 28.6)            |
South Carolina          | 32.1       | (30.9, 33.3)            |
South Dakota            | 29.8       | (27.9, 31.8)            |
Tennessee               | 31.2       | (29.3, 33.2)            |
Texas                   | 31.9       | (30.6, 33.3)            |
Utah                    | 25.7       | (24.9, 26.6)            |
Vermont                 | 24.8       | (23.5, 26.1)            |
Virginia                | 28.5       | (27.2, 29.7)            |
Washington              | 27.3       | (26.0, 28.5)            |
West Virginia           | 35.7       | (34.2, 37.2)            |
Wisconsin               | 31.2       | (29.6, 32.8)            |
Wyoming                 | 29.5       | (27.5, 31.5)            |

*Prevalence estimates reflect BRFSS methodological changes started in 2011. These estimates should not be compared to prevalence estimates before 2011. Source: Behavioral Risk Factor Surveillance System, CDC.*
Mortality from Cancer According to BMI for U.S. Women.

Type of Cancer: Uterus, Kidney, Cervix, Pancreas, Esophagus, Gallbladder, Breast, NHL, Liver, Ovary, Colorectal, MM

Relative Risk of Death

Gynecologic Laparoscopic Surgery

- **1953**: Ectopic Dx
- **1961**: Celioscopy
- **1973**: Sterilization
- **1974**: Ovarian Biopsy
- **1978**: Operative Laparoscopy
- **1980s**: GYN Oncology Evaluation
- **1991-1992**: Radical Hysterectomy
- **1992**: Endometrial Cancer Staging
Querleu (1991)
Laparoscopic Pelvic LND (n=39)

Childers (1992)
LAVH/BSO + Nodes

Childers (1993)
LAVH +/- P&PALND
N=59

Querleu (1993)
PALND
N=4

Childers (1994)
Re-Operation for Staging (N=13)
Querleu (1991) Laparoscopic Pelvic LND (n=39)

Childers (1992) LAVH/BSO + Nodes

Mage (1995) Stage I (N=17)

Kadar (1995) Pelvic LND in Obese

Eltabakh (2000) Learning Curve (N=75)

Tozzi (2005) Survival Randomized (N=63)

Holub (2002) LAVH vs TAH (N=177)

Langebrekke (2002) LAVH vs TAH (N=51)

Malzoni (2009) TLH vs TAH Randomized (N=81)

Childers (1993) LAVH +/- P&PALND N=59

Querleu (1993) PALND N=4

Possover (1998) Pelvic & Aortic LND (N=150)

Childers (1994) Re-Operation for Staging (N=13)

Eltabakh (2000) Learning Curve (N=100)

Elderly Feasible (N=67)

Scribner (2001) GOG Feasibility (N=50)

Homesley (2004) GOG Feasibility (N=50)

Kuoppala (2004) LAVH vs TAH (N=40)

Eltabakh (2002) Survival (N=100)

Elderly Feasible (N=67)

GOG (2010) Lap 2 Trial
84% utilize laparoscopy
55% feel more laparoscopy needed in training

ONLY 3% perform >50% of cases via scope
(2004)
“Technically frustrating”

“Significantly prolongs OR time”

“Limited applicability to typical gynecologic oncology patients”
Conventional ("Straight Stick") Laparoscopic Surgery

2–D flat image video

Rigid instruments

Unstable camera platform

Instruments controlled at a distance = limited precision and dexterity

"Technically frustrating" Circa. 1991

Surgeon fatigue
Laparoscopy Compared With Laparotomy for Comprehensive Surgical Staging of Uterine Cancer: Gynecologic Oncology Group Study LAP2


Endometrial Cancer Clinical Stage I-IIA

Laparoscopy (N=1696)

Laparotomy (N=920)

10.1200/JCO.2009.22.3529
Laparoscopy is feasible:

Conversion rate 25.8%

SAME in both arms:

cytology + rate

Advanced stage %

Node + rate

10.1200/JCO.2009.22.3529
Laparoscopy has improved safety profile:

Fewer post-operative events (grade ≥ 2)

Less antibiotic use and shorter hospital stay

10.1200/JCO.2009.22.3529
Laparoscopy associated with:

- Higher FACT-G scores
- Better physical functioning
- Better body image
- Less pain
- Earlier resumption of normal activities
- Earlier return to work

Quality of Life of Patients With Endometrial Cancer Undergoing Laparoscopic International Federation of Gynecology and Obstetrics Staging Compared With Laparotomy: A Gynecologic Oncology Group Study

Alice B. Kornbluth, Helen Q. Huang, Joan L. Walker, Nick M. Spirtos, Jacob Rotmensch, and David Cella

10.1200/JCO.2009.22.3248
Laparoscopy Compared With Laparotomy for Comprehensive Surgical Staging of Uterine Cancer: Gynecologic Oncology Group Study LAP2


“Laparoscopy is feasible”

BUT, conversion rate **25.8%**!

AND, for BMI>40 conversion rate **57.1%**!
History of Robotic Gynecologic Surgery

- **1999**
  - Tubal Anastomosis

- **2001**
  - Pig Adnexectomy & Hysterectomy

- **2002**
  - Robotic LAVH
    - N=11

- **2004**
  - Sacral Colpopexy
    - N=5
  - Myomectomy
    - N=35
  - TLH
    - N=10
  - Robotic LAVH
    - N=11

- **2005 March**
  - Radical Hyst & PLND
Robotic surgery in gynecologic oncology: program initiation and outcomes after the first year with comparison with laparotomy for endometrial cancer staging

Dan S. Veljovich, MD; Pamela J. Paley, MD; Charles W. Drescher, MD; Elise N. Everett, MD; Chirag Shah, MD; William A. Peters III, MD

OBJECTIVE: The objective of the study was to evaluate outcomes during the first year of a robotic surgery program in gynecologic oncology.

STUDY DESIGN: We studied the initiation of a robotic surgery program with prospective data collection, including intraoperative times, estimated blood loss (EBL), length of stay (LOS), lymph node yields, and complications. Patients were compared with historical and contemporary open staging surgery for endometrial cancer.

RESULTS: One hundred eighteen patients underwent robotic surgery (mean age 52.5 years, body mass index of 26.3 kg/m², hospital stay of 32.4 hours), with 8 major and 13 minor complications. Compared with open endometrial staging (n = 131), the robotic procedure (n = 25) was longer (283 vs 139 minutes, P < .0001), had less blood loss (66.6 vs 197.6 mL, P < .0001), and had shorter length of stay (40.3 vs 127 hours, P < .0001) with comparable node yields (17.5 vs 13.1, P = .1109).

CONCLUSION: Robotic surgery is feasible in gynecologic oncology and facilitated a dramatic expansion in our minimally invasive surgical practice. Despite longer operative times, EBL and LOS are reduced and lymph node yields are comparable.

Key words: endometrial carcinoma, laparoscopy, lymphadenectomy, robotic surgery


LESS blood loss
SHORTER length of stay
COMPARABLE (or better) nodal yields
Robotic surgery in gynecologic oncology: program initiation and outcomes after the first year with comparison with laparotomy for endometrial cancer staging

What is the optimal minimally invasive surgical procedure for endometrial cancer staging in the obese and morbidly obese woman?

ONCOLOGY

A comparative study of 3 surgical methods for hysterectomy with staging for endometrial cancer: robotic assistance, laparoscopy, laparotomy

Robotic Hysterectomy and Pelvic–Aortic Lymphadenectomy for Endometrial Cancer

Comparison of outcomes and cost for endometrial cancer staging via traditional laparotomy, standard laparoscopy and robotic techniques

Robotically assisted laparoscopic hysterectomy versus total abdominal hysterectomy and lymphadenectomy for endometrial cancer

Sara A. DeNardis*, Robert W. Holloway, Glenn E. Bigsby IV, Dirk P. Pikaart, Sarfraz Ahmad, Neil J. Finkler

Gynecologic Oncology Program, Florida Hospital Cancer Institute, 2501 N. Orange Avenue, Suite 689, Orlando, FL 32804, USA
Operative Times Longer Than Laparotomy (But same or better than laparoscopy)

Outcomes Are Better Than Laparotomy

Blood loss

Complication rates

Hospital stay

Node Counts are Same or Better than Laparotomy OR Laparoscopy
Minimally invasive comprehensive surgical staging for endometrial cancer: Robotics or laparoscopy?

The impact of robotics on practice management of endometrial cancer: transitioning from traditional surgery

Comprehensive Surgical Staging for Endometrial Cancer in Obese Patients
Comparing Robotics and Laparotomy

Robotic surgery: changing the surgical approach for endometrial cancer in a referral cancer center.

A detailed analysis of the surgical learning curve: Robotic hysterectomy and pelvic-aortic lymphadenectomy for endometrial cancer

Robotic-assisted laparoscopic hysterectomy and lymphadenectomy for endometrial cancer: Analysis of surgical performance

Leigh G. Seamon, Jeffrey M. Fowler, Debra L. Richardson, Matthew J. Carlson, Sue Valmadre, Gary S. Phillips, David E. Cohn

Division of Gynecologic Oncology, Department of Obstetrics and Gynecology, Cleveland Clinic, Cleveland, Ohio, USA

Gynecologic Oncology Program, Florida Hospital Cancer Institute and Global Robotics Institute, 2501 N. Orange Ave., Suite 800, Orlando, FL 32804, USA
Minimally invasive comprehensive surgical staging for endometrial cancer: Robotics or laparoscopy?

The impact of robotics on practice management

Conversion Rates Lower Than Laparoscopy
12% vs. 26% @ Ohio State

Reproducible/Generalizable
Low conversion and complication rates across multiple centers

Allows Change in Practice Patterns
From laparotomy to MIS
91% utilize laparoscopy
78% feel more laparoscopy needed in training

24% utilize robotic-assisted laparoscopy
66% planning to increase use of robotics within yr
(2009)
Surgical outcomes in gynecologic oncology in the era of robotics: analysis of first 1000 cases

Pamela J. Paley, MD; Dan S. Veliovich, MD; Chirag A. Shah, MD, MPH; Elise N. Everett, MD; Amy E. Bondurant, MD; Charles W. Drescher, MD; William A. Peters III, MD

OBJECTIVE: We sought to examine outcomes in an expanding robotic surgery (RS) program.

STUDY DESIGN: In all, 1000 women underwent RS from May 2006 through December 2009. We analyzed patient characteristics and outcomes. A total of 377 women undergoing RS for endometrial cancer staging (ECS) were compared with the historical data of 131 undergoing open ECS.

RESULTS: For the entire RS cohort of 1000, the conversion rate was 2.9%. Body mass index increased over 3 time intervals: T1 = 26.2, T2 = 29.5, T3 = 30.1 (T1:T2, P = .01; T1:T3, P = .0001; T2:T3, P = .037). Increasing body mass index was not associated with increased major complications: T1 = 8.7%, T2 = 4.3%, T3 = 5.7%. In the ECS cohort, as compared with open ECS, women undergoing RS had lower blood loss (46.9 vs 197.6 ml, P < .0001), shorter hospitalization (1.4 vs 5.3 days, P < .0001), fewer major complications (6.4% vs 20.6%, P < .0001), with higher lymph node counts (15.5 vs 13.1, P = .007).

CONCLUSION: RS is associated with favorable morbidity and conversion rates in an unselected cohort. Compared to laparotomy, robotic ECS results in improved outcomes.

Key words: endometrial carcinoma, robotic surgery, surgical morbidity


LESS blood loss
SHORTER length of stay
FEWER major complications
HIGHER nodal yields
Conversions by BMI

(\textit{n}=1000)

<table>
<thead>
<tr>
<th>BMI Category</th>
<th>BMI n</th>
<th>Conversions n</th>
<th>Conversions %</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;30 (normal or overweight)</td>
<td>631</td>
<td>17</td>
<td>2.7%</td>
</tr>
<tr>
<td>30-39.9 (obese)</td>
<td>283</td>
<td>6</td>
<td>2.1%</td>
</tr>
<tr>
<td>≥40 (morbidly obese)</td>
<td>99</td>
<td>6</td>
<td>6.1%</td>
</tr>
</tbody>
</table>
Swedish Medical Center

Endometrial Cancer Surgical Evolution

Year | MIS | Open | Total
--- | --- | --- | ---
2005-2006 | 6.4% | | 100
2006-2007 | 42.6% | | 200
2007-2008 | 68.8% | | 300
2008-2009 | 80.5% | | 400

Robotics
ENDOMETRIAL CANCER: “Less is more”:
Reduction in Lymphadenectomy Morbidity with Technology
Roboticly assisted fluorescence-guided lymph node mapping with ICG for gynecologic malignancies: A feasibility study

Emma C. Rossi, Anastasia Ivanova, John F. Bogess

Objective. Traditional techniques of sentinel lymph node (SLN) mapping for endometrial and cervical cancer present challenges which may be overcome with newer technologies such as near infrared (NIR) imaging of the fluorescent dye Indocyanine green (ICG). We performed a feasibility and dose-finding study to define the dose of ICG required to identify pelvic and para-aortic sentinel lymph nodes with robotically assisted endoscopic NIR imaging after cervical injection.

Methods. 20 subjects with cervical or endometrial carcinoma were prospectively enrolled for SLN mapping. ICG was injected into the cervical stroma at 1 cricketh and 8 cricketh dose was collected for the number of nodes identified, the location of SLN's, the duration of procedure and the pathology characteristics of the SLN's compared to the non-sentinel lymph nodes.

Results. 20 subjects received cervical injection with at least one SLN observed in 17 subjects. 15 of the 17 subjects who received 1 mg injections of ICG mapped a SLN for an observed detection rate of 88% (95% CI is 64-98%). A median of 4.7 SLN's was identified per patient. Three patients had lymphatic metastases, one of whom had a positive SLN. No adverse events were identified.

Conclusion. A 1 mg cervical injection of ICG identified a SLN in 88% of patients (95% CI is 64-98%). Roboticly assisted fluorescence imaging is a feasible, safe, time efficient and reliable method for lymphatic mapping in early stage cervical and endometrial cancer.

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Fig. 2. Appearance of resected right pelvic sentinel lymph node in a) conventional imaging, and b) fluorescence imaging for the da Vinci®.

Fig. 4. Anatomic distribution of SLN's detected with fluorescence-guided NIR imaging after cervical injection.
Detection of sentinel lymph nodes in patients with endometrial cancer undergoing robotic-assisted staging: A comparison of colorimetric and fluorescence imaging

Robert W. Holloway *, Ricardo A. Molerio Bravo, Joseph A. Rakowski, Jeffrey A. James, Corinne N. Jeppson, Susan B. Ingersoll, Sarfraz Ahmad

Florida Hospital Gynecologic Oncology, Florida Hospital Cancer Institute and the Global Robotics Institute, Orlando, FL 32804, USA

ARTICLE INFO

Objective: To retrospectively compare results from lymphatic mapping of pelvic sentinel lymph nodes (SLN) using fluorescence near-infrared (NIR) imaging of indocyanine green (ICG) and colorimetric imaging of iotopan blue (IB) dye in women with endometrial cancer (EC) undergoing robotic-assisted lymphadenectomy (RAL). A secondary aim was to investigate the ability of SLN biopsies to increase the detection of metastatic disease.

Methods: Thirty-five patients underwent RAL with lymphadenectomy. One ml IB was injected submucosally in four quadrants of the cervix, followed by 0.5 ml ICG (1.25 mg/ml) immediately prior to placement of a uterine manipulator. Retropertioneal spaces were dissected for colorimetric detection of lymphatic pathways. The da Vinci® camera was switched to fluorescence imaging and results recorded. SLN were removed for permanent analysis with ultra-sectioning, H&E, and ICG staining. Hysterectomy with RAL was completed.

Results: Twenty-seven (77%) of 34 (97%) of patients had bilateral pelvic or uterine SLN detected by colorimetric and fluorescence, respectively (p = 0.05). Considering a 6-point pelvic examination, 17 (50.0%) had "weak" uptake of IB or ICG confirmed positive with fluorescence imaging. Using both methods, bilateral detection was 100%. Ten (28.5%) patients had lymph node (LN) metastasis, and 9 of these had SLN metastasis (90% sensitivity, one false negative: SLN biopsy). Seven of nine (78%) SLN metastases were IB positive and 100% were ICG positive. Twenty-five had normal LN, all with negative SLN biopsies (100% specificity). Four (40%) with LN metastasis were detected only by fluorescence and ultra-sectioning of SLN.

Conclusions: Fluorescence imaging with ICG detected bilateral SLN and SLN metastasis more often than IB, and the combination resulted in 100% bilateral detection of SLN Ultra-sectioning/DIC of SLN increased the detection of lymph node metastasis.

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Introduction

Lymphatic mapping for assessment of sentinel lymph nodes (SLN) is an accepted practice for breast, melanoma, and vulvar cancers [1-3] with the primary goal to reduce mortality of a complete lymphadenectomy. A secondary goal is to improve detection of metastatic disease with pathologic protocols that utilize ultra-sectioning of SLN and immunohistochemical (IHC) staining [4]. In 2008, a consensus panel of experts reported that sentinel node assessment in endometrial cancer was worthy of further investigation; however, there was insufficient data to comment on feasibility or benefits [5]. Since then, investigators have reported on their experiences with pelvic lymphatic mapping using colorimetric imaging of blue dyes [iodotopan blue (IB), patient blue, and methylene blue] and/or radionuclide mapping with Technetium-99m (Tc-99m). Bilateral detection of pelvic lymph nodes is reported in 66 to 88% of cervical and endometrial cancer cases [6-9]. Furthermore, Roy et al. [9] reported a 7.8% increase in SLN detection utilizing both IB and Tc-99m compared to IB alone, achieving a 90% bilateral detection rate in patients with cervical cancer. However, radionuclide mapping suffers from difficulties associated with coordinating injection times in the radiology suite relative to operating times when imaging is desired, variability of operators' ability to interpret the radioactive signal intraoperatively, cost, and patient concerns with injection of radioactive pharmaceuticals.

Recently, other medical dyes that fluoresce in light at the near-infrared (NIR) spectrum (700-900 nm) using laparoscopic imaging systems have been reported for use in lymphatic mapping of gynecologic, breast, rectal, cervical, and endometrial cancers [10-16]. Indocyanine green (ICG) is the most clinically useful agent for NIR lymphatic mapping [15], and has been used clinically for two decades with an excellent safety profile. The risk of allergic reactions with ICG has been estimated 1 per 42,200 uses [16]. The da Vinci® NIR fluorescence imaging system...
Fig. 1. (A) Colorimetric detection of isosulfan blue (ISB) in left parametrial lymphatics leading to left external iliac lymph node. (B) Near-infrared (NIR) imaging of indocyanine green (ICG) in the same patient showing parametrial lymphatics and left external iliac lymph node.

Fig. 2. (A) Colorimetric view of isosulfan blue (ISB) in right parametria leading to obturator space, but fails to identify a sentinel lymph node (SLN). (B) Near-infrared (NIR) imaging of indocyanine green (ICG) dye confirms obturator SLN.
Comparing indocyanine green, technetium, and blue dye for sentinel lymph node mapping in endometrial cancer


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B Department of Pathology, Segal Cancer Center, Jewish General Hospital, McGill University, Montreal, QC H3T 1E2, Canada
C Department of Nuclear Medicine, Segal Cancer Center, Jewish General Hospital, McGill University, Montreal, QC H3T 1E2, Canada
D Division of Experimental Surgery, Faculty of Medicine, McGill University, Montreal, QC, Canada

HIGHLIGHTS
- Cervical injection of dye allows precise paraotic mapping of sentinel lymph nodes
- ICG and technetium produce better mapping than blue dye
- Sentinel nodes sometimes map to areas not routinely sampled during lymphadenectomy

ABSTRACT
Background and aims. With the debate over extent of lymphadenectomy in endometrial cancer, sentinel lymph node (SLN) mapping may provide a focused approach to evaluate the most relevant lymph nodes (LN) while minimizing the complications. We evaluated SLN mapping using filtered technetium-99m, indocyanine green (ICG), and blue dye.

Methods. Prospective evaluation of 100 patients who underwent SLN mapping by using subcapsular and deep stromal cervical injections of technetium-99m, ICG, and blue dye as part of the staging for endometrial cancer.

Results. 288 SLNs were mapped (2.9 per patient) in 92% of patients. The bilateral detection rate was 76%. ICG had a significantly higher SLN detection rate than blue dye in both overall (67% vs 71%, respectively, p = 0.005) and bilateral (62% vs 71%, respectively, p = 0.02) detection, but similar SLN detection rates compared to technetium-99m in both overall (87% vs 91%, respectively, p = 0.18) and bilateral (90% vs 71%, respectively, p = 0.16) detection. In eight cases, the SLN was in the para-aortic area and in 14 cases in the presacral, hypogastric vein, or parametrial area. In nine cases, the SLN was positive for metastasis, and in seven cases the SLN was the only positive node. One SLN was falsely negative. No complications or anaphylactic reactions occurred.
CONSENT FORM

A Prospective Investigation of the Use of Fluorescence Imaging on the da Vinci Surgical System for Ultrastaging of Endometrial Cancer by Sentinel Node Assessment

Participating Institutions:
Swedish Cancer Institute
Washington

Pacific Gynecology Specialists
Seattle, Washington

INVESTIGATOR: ____________________________

24-HOUR PHONE: __206-965-1700

This is a type of research study. Research studies include only people who choose to take part. Please take your time to make your decision to participate. Discuss it with your friends and family. You are being asked to take part in this study because you are planning to undergo standard robotic surgery to have your endometrial cancer removed.

This consent form may contain words that you do not understand. Please ask the study doctor or study staff any questions that you have. The following is a summary of the information you were given when this study was discussed with you.
A prospective investigation of fluorescence imaging to detect sentinel lymph nodes at robotic-assisted endometrial cancer staging

Presented at the Pacific Coast Obstetrical and Gynecological Society Eighty-second Annual Meeting, September 2-6, 2015, Kahuku, Oahu, Hawaii

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FINDINGS

119/123 patients had at least one sentinel node (97%)
10.6% had lymph node metastases
- SLN was ONLY POSITIVE NODE in 44% of LN+ cases
- NO CASES had –SLN and +LN mets in nodal basins
  (false negative rate=0)
PRINCIPLES OF EVALUATION AND SURGICAL STAGING WHEN SLN MAPPING IS USED

Principles of Sentinel Lymph Node (SLN) Mapping for Endometrial Cancer Staging

- The role of SLN mapping in endometrial carcinoma is under evaluation. Prospective and retrospective studies demonstrate that compared to systemic lymphadenectomy, SLN mapping with ultrastaging may increase the detection of lymph node metastases with low false-negative rates in women with apparent uterine-confined disease. To date, no randomized trials evaluating this technique in endometrial carcinoma have been conducted. If SLN mapping is considered, the expertise of the surgeon and attention to technical detail is critical. The use of SLN mapping in high-risk histologies (serous carcinoma, clear cell carcinoma, or carcinosarcoma) should be undertaken with particular caution.

- SLN mapping can be considered for the surgical staging of apparent uterine-confined malignancy when there is no metastasis demonstrated by imaging studies or no obvious extraterine disease at exploration.

- A cervical injection with dye has emerged as a useful and validated technique for identification of lymph nodes that are at high risk for metastases (i.e., SLN in patients with early-stage endometrial cancer).

- The combination of a superficial (1–3 mm) and deep (1–2 cm) cervical injection leads to dye delivery to the main layers of lymphatic channel origins in the cervix and corpus, namely the superficial subserosal, intermediate stromal, and deep submucosal lymphatic sites of origin (Figure 1 on END0-C 3 of 5).

- Injection into the uterine cervix provides excellent dye penetration to the region of the uterine vessels and main uterine lymphatic trunks that condense in the parametra and appear in the broad ligament leading to pelvic and occasionally paraaortic sentinel nodes.

- The uterine body lymphatic trunks commonly cross over the obliterated umbilical artery with the most common location of pelvic SLN being medial to the external iliac, ventral to the hypogastric, or in the superior part of the obturator region (Figure 2 on END0-C 3 of 5).

- A less common location is usually seen when the lymphatic trunks do not cross over the obliterated umbilical and move cephalad following the mesouter; in these cases, the SLN is usually seen in the common iliac presacral region (Figure 3 on END0-C 3 of 5).

- The radiolabeled colloid most commonly injected into the cervix is technetium-99m (99mTc); colored dyes are available in a variety of forms (isosulfan Blue 1% and Methylene Blue 1%, Patent Blue 2.5% sodium).

- Indocyanine green (ICG) recently emerged as a useful imaging dye that requires near-infrared camera for localization, provides a very high SLN detection rate, and is commonly used in many practices at the present time.

- Low-volume nodal metastasis to SLN detected only by enhanced pathologic ultrastaging is another potential value to staging with SLN.

- Key points to a successful SLN mapping is the adherence to the SLN algorithm, which requires the performance of a site-specific nodal dissection in cases of failed mapping and removal of any suspicious or grossly enlarged nodes regardless of mapping (Figure 4 on END0-C 4 of 5).

Note: All recommendations are category 2A unless otherwise indicated.

Clinical Trials: NCCN believes that the best management of any patient with cancer is in a clinical trial. Participation in clinical trials is especially encouraged.
NCCN Guidelines Version 2.2017
Endometrial Carcinoma

PRINCIPLES OF EVALUATION AND SURGICAL STAGING WHEN SLN MAPPING IS USED

Figure 1: Common cervical injection sites for mapping uterine cancer

Figure 2: Most common location of SLNs (blue, arrow) following a cervical injection

Figure 3: Less common location of SLNs (green, arrow) usually seen when lymphatic trunks are not crossing over the umbilical ligament but following the mesorectum cephalad to common iliac and presacral region

Note: All recommendations are category 2A unless otherwise indicated.
Continued
**NCCN Guidelines Version 2.2017**

**Endometrial Carcinoma**

**PRINCIPLES OF EVALUATION AND SURGICAL STAGING WHEN SLN MAPPING IS USED**

Figure 4: The SLN algorithm for surgical staging of endometrial cancer*

1. Peritoneal & serosal evaluation & washings
2. Retropertitoneal evaluation
   - Excision of all mapped SLN with ultrastaging
   - Any suspicious nodes must be removed regardless of mapping
3. If there is no mapping on a hemi-pelvis, a side-specific LND is performed
4. Para-ortic LND—done at attending discretion


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Clinical Trials: NCCN believes that the best management of any patient with cancer is in a clinical trial. Participation in clinical trials is especially encouraged.
Take Home Points:

Despite longstanding video laparoscopic infrastructure, laparoscopic penetration in gynecologic oncology was low.

The robotic platform, utilizing a computer interface between the surgeon and the instruments, has “democratized” minimally invasive surgery.

Utilization of ICG dye and infrared vision with robotic surgery has allowed “minimally invasive lymph node evaluation” via sentinel lymph node dissection.

Both technologies will dramatically reduce morbidity and mortality from surgical intervention for endometrial cancer as compared to conventional laparotomy approach and comprehensive lymph node dissection.
OVARIAN CANCER: “Less is more”:
Reduction in Radicality of Resection and higher “OPTIMAL” rates with NEOADJUVANT Chemotherapy (2010)
Robotic Surgery for Ovarian Carcinoma

**Standard Surgical Therapy**

1. Total abdominal hysterectomy with bilateral salpingo-oophorectomy
2. Surgical Staging (Omentectomy, nodal dissection, and biopsies)
3. Removal of *all* visible tumor
Innovations in Gynecologic Cancer Care

5/12/2017

ORIGINAL ARTICLE

Neoadjuvant Chemotherapy or Primary Surgery in Stage IIIC or IV Ovarian Cancer

Ignace Vergote, M.D., Ph.D., Claes G. Trope, M.D., Ph.D., Frédéric Amant, M.D., Ph.D., Gunnar B. Kristensen, M.D., Ph.D., Tom Ehlen, M.D., Nick Johnson, M.D., René H. M. Verheyen, M.D., Ph.D., Maria E. van der Burg, M.D., Ph.D., Angel J. Lacave, M.D., Pier Luigi Benedetti Panici, M.D., Ph.D., Gemma G. Kenis, M.D., Ph.D., Antonio Casado, M.D., Cesar Mendola, M.D., Ph.D., Conrel Coens, M.Sc., Leen Verleye, M.D., Gavin C.E. Stuart, M.D., Sergio Pecorari, M.D., Ph.D., and Nick S. Reed, M.D., for the European Organization for Research and Treatment of Cancer–Gynaecological Cancer Group and the NCIC Clinical Trials Group* — a Gynecologic Cancer Intergroup Collaboration

ABSTRACT

BACKGROUND

Primary debulking surgery before initiation of chemotherapy has been the standard of care for patients with advanced ovarian cancer.

METHODS

We randomly assigned patients with stage IIIC or IV epithelial ovarian carcinoma, fallopian-tube carcinoma, or primary peritoneal carcinoma to primary debulking surgery followed by platinum-based chemotherapy or to neoadjuvant platinum-based chemotherapy followed by debulking surgery (so-called interval debulking surgery).

RESULTS

Of the 672 patients randomly assigned to a study treatment, 632 (94.3%) were eligible and started the treatment. The majority of these patients had extensive stage IIIC or IV disease at primary debulking surgery (metastatic lesions that were larger than 5 cm in diameter in 74.9% of patients and larger than 30 cm in 61.6%). The largest residual tumor was 1 cm or less in diameter in 41.6% of patients after primary debulking and in 80.6% of patients after interval debulking. Postoperative rates of adverse effects and mortality tended to be higher after primary debulking than after interval debulking. The hazard ratio for death (intent-to-treat analysis) in the group assigned to neoadjuvant chemotherapy followed by interval debulking, as compared with the group assigned to primary debulking surgery followed by chemotherapy, was 0.98 (95% confidence interval [CI], 0.84 to 1.13; P=0.01 for non-inferiority), and the hazard ratio for progressive disease was 1.01 (95% CI, 0.80 to 1.15). Complete resection of all macroscopic disease (at primary or interval surgery) was the strongest independent variable in predicting overall survival.

CONCLUSIONS

Neoadjuvant chemotherapy followed by interval debulking surgery was not inferior to primary debulking surgery followed by chemotherapy as a treatment option for patients with bulky stage IIIC or IV ovarian carcinoma in this study. Complete resection of all macroscopic disease, whether performed as primary treatment or after neoadjuvant chemotherapy, remains the objective whenever cytoreductive surgery is performed. (Funded by the National Cancer Institute; ClinicalTrials.gov number, NCT0009096.)

*Other collaborations are listed in the Appendix.

The New England Journal of Medicine

Downloaded from www.nejm.org at UNIVERSITY OF WASHINGTON on September 17, 2010. For personal use only. No other use without permission. Copyright © 2010 Massachusetts Medical Society. All rights reserved.
Figure 2. Overall Survival in the Intention-to-Treat Population and Overall Survival According to Treatment Received and Status with Respect to Residual Tumor.

The median overall survival was 29 months among the women assigned to primary debulking surgery and 30 months among those assigned to neoadjuvant chemotherapy (Panel A). The median overall survival for women with no residual tumor (optimal result), those with residual tumors that measured 1 to 10 mm in diameter (suboptimal result), and those with residual tumors larger than 10 mm (other result) was 45, 32, and 26 months, respectively, in the group that underwent primary debulking surgery and 38, 27, and 25 months, respectively, in the group that underwent neoadjuvant chemotherapy (Panel B).
Vergote

Neoadjuvant Chemotherapy

POSTOPERATIVE DEATH
-2.5% PDS vs. 0.7% IDS

GRADE ¾ Hemorrhage
-7.4% PDS vs. 4.1% IDS

INFECTION
-8.1% PDS vs. 1.7% IDS

VENOUS COMPLICATIONS
-2.6% PDS vs. 0% IDS
NCCN Guidelines Version 1.2017
Epithelial Ovarian Cancer/Fallopian Tube Cancer/Primary Peritoneal Cancer

**CLINICAL PRESENTATION**
- Suspicous palpable pelvic mass on abdominal/pelvic exam and/or ascites, abdominal distention and/or symptoms without source of malignancy (ie, bloating, pelvic/abdominal pain, difficulty eating or feeling full quickly, urinary symptoms [urgency or frequency])

**WORKUP**
- Obtain family history, if clinically indicated
- Abdominal/pelvic exam
- Chest x-ray or chest CT as clinically indicated
- Complete blood count, chemistry profile with liver function test (LFT)
- GI evaluation for mucinous histology
- Ultrasound and/or abdominal/pelvic CT/MRI as clinically indicated
- CA-125 or other tumor markers as clinically indicated
- Evaluate total serum protein and nutritional status

**CLINICAL STAGE**
- IA (fertility desired)
- IB (fertility desired)
- IA-IV, surgical candidate (fertility not desired)
- Bulky stage III-IV, or poor surgical candidate

**PRIMARY TREATMENT**
- Unilateral salpingo-oophorectomy (USO) + comprehensive surgical staging
- Bilateral salpingo-oophorectomy (BSO) + comprehensive surgical staging
- Laparotomy/total abdominal hysterectomy (TAH)/BSO + comprehensive staging and debulking as needed

**Diagnosis by previous surgery or tissue biopsy (cytopathology)**

See Workup, Findings and Primary Treatment (OV-2)

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Pregnancy should not be delayed for a genetic counseling referral.

PET/CT or MRI may be indicated for indeterminate lesions if results will alter management.

Other tumor markers may include inhibin, beta-human chorionic gonadotropin (β-hCG), alpha-fetoprotein, lactate dehydrogenase (LDH), and carcinoembryonic antigen (CEA). See Discussion for usefulness of diagnostic tests.

**PRIMARY TREATMENT**

- All patients with ovarian cancer, Fallopian tube cancer, or primary peritoneal cancer should be referred for genetic risk evaluation.

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**Note:** All recommendations are category 2A unless otherwise indicated.

Clinical Trials: NCCN believes that the best management of any patient with cancer is in a clinical trial. Participation in clinical trials is especially encouraged.

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OVARIAN CANCER: 
“Less is more”: 
Minimally Invasive Techniques 
(2007)
Robotic Surgery for Ovarian Carcinoma

Advantages of Minimally Invasive Surgery

Less blood loss

Shorter length of stay

Faster return to normal function

Improved quality of life
Robotic Surgery for Ovarian Carcinoma

History of Laparoscopic Surgery

Laparoscopy for Second-Look Evaluation in Ovarian Cancer

JONATHAN S. BEREK, MD, C. THOMAS GRUFFITHS, MD, AND JOHN W. LEEVANTH, MD

Although initial skepticism in anatomy primed with the advantages of laparoscopic surgery has been generally accepted, laparoscopic surgery has been considered increasingly less invasive than open surgery due to the benefits of smaller incisions, reduced postoperative pain, and faster recovery. Over the past 30 years, laparoscopic surgery has evolved from a diagnostic technique to a therapeutic modality, with the revolution in laparoscopic technology and surgical techniques.

1980s

Laparoscopic Surgical Staging of Ovarian Cancer

John M. Cheek, MD, Jodie Long, MD, John A. Shariat, MD, AND Katherine D. Robin, MD

University of Virginia Department of Obstetrics and Gynecology, Division of Gynecologic Oncology, Charlottesville, Virginia

Abstract

Objectives: To compare the results of laparoscopic staging of apparent early stage ovarian cancer (EOC) with those obtained with comprehensive surgical staging by laparotomy.

Methods: Contemporary patients undergoing comprehensive laparoscopic staging for primary EOC (62 cases) were compared with historical controls (65 cases) who had undergone surgical staging with laparotomy (LPT) group.

Results: No difference was found in demographics and preoperative variables between the two groups. There was no significant differences between the two groups with regard to interval to operation, size and location of the primary tumor, involvement of adjacent organs, and nodal involvement. There was a significantly higher rate of detection of metastatic disease in the LPT group (p = 0.008). The rate of documentation of metastases was higher in the LPT group (p = 0.04).

Conclusions: Laparoscopic staging of apparent early stage ovarian cancer is as safe and adequate as the standard surgical staging procedure.

Laparoscopic versus laparotomy for the surgical management of apparent early stage ovarian cancer

Fabio Ghezzi 1,2, Antonella Croce 1, Stefano Uccella 1, Valentine Benjamin 1, Silvia Tonner 1, Massimiliano Fanchi 1, Pietrofrancesco Balsamo 1

1 Department of Obstetrics and Gynecology, University of Ferrara, Italy. 2 Department of Obstetrics and Gynecology, University of Ferrara, Italy. 3 Department of Obstetrics and Gynecology, University of Ferrara, Italy. 4 Department of Obstetrics and Gynecology, University of Ferrara, Italy.

Randomization date: 20 October 2012

Available online: 11 January 2017

1990s

2000s

Secondary or secondlook laparotomies have been the crucial step of all surgical advancements, and the operative and histopathologic findings have been the basis for preoperative and postoperative situations of disease. The development of a minimally invasive technology for the identification of circulating tumor cell (CTC) technology is a significant step in the diagnosis and treatment of cancer.

Conclusion

Products are not yet available in the market.
Surgical staging and cytoreductive surgery for ovarian cancer with minimally invasive techniques was *more common* since initiation of our robotic surgery program.

Surgical staging and cytoreductive surgery for ovarian cancer with minimally invasive techniques was *feasible and may offer benefits similar to those shown for women undergoing surgery for cervical and endometrial cancer*.
Robotic Surgery for Ovarian Carcinoma

Objectives

Determine our utilization patterns of the robotic platform for surgical treatment of women with ovarian/tubal/primary peritoneal cancer

Evaluate endpoints including blood loss, length of surgery and length of stay, complications rates, and nodal counts
Robotic Surgery for Ovarian Carcinoma

**Materials & Methods**

Swedish IRB# 4976S-10

Inclusion Criteria=All patients undergoing surgery *at Swedish Medical Center* for ovarian cancer since inception of robotics program (May 9, 2006-May 8, 2012)

Search through office billing records from initiation of electronic submission with Centricity (does not encompass all of first year of program)
Robotic Surgery for Ovarian Carcinoma

Port Placement
Robotic Surgery for Ovarian Carcinoma

**Instruments**

- Monopolar Scissors
- OR
- Maryland Bipolars
- Suture Cut Needle Driver
- Prograsp Grasper
- L Arm
- R Arm
- 4th Arm
Robotic Surgery for Ovarian Carcinoma

Study Population

Met Search Criteria
N=2351

NOT Ovarian CA
N=1578

Ovarian CA
N=773

Diagnostic (N=7)
Palliative (N=7)
Port Removal (N=5)

Primary, Interval or Secondary Cytoreduction; Staging Surgery
N=754
Robotic Surgery for Ovarian Carcinoma

Study Population

Cytoreductive or Staging Surgery
N=754

Primary Cytoreduction
N=449
- Open N=398
  - Conversion N=8
  - Laparoscopy N=6
- Robotic Primary Cytoreduction
  N=37

Interval Cytoreduction
N=144
- Open N=128
  - Conversion N=1
- Robotic Interval Cytoreduction
  N=15

Secondary Cytoreduction
N=84
- Open N=72
  - Conversion N=1
- Robotic Secondary Cytoreduction
  N=11

Staging Surgery
N=77
- Open N=14
  - Conversion N=3
- Robotic Staging Surgery
  N=60
Robotic Surgery for Ovarian Carcinoma

PRIMARY CYTOREDUCTIVE SURGERY

Conversion
Laparoscopic
Robotic
Open

N=449
Robotic Surgery for Ovarian Carcinoma

INTERVAL CYTOREDUCTIVE SURGERY

N=144

Conversion
Robotic
Open
Robotic Surgery for Ovarian Carcinoma
SECONDARY CYTOREDUCTIVE SURGERY

N=84

Conversion  Robotic  Open

11.8%  15.8%  29.4%
7.7%
Robotic Surgery for Ovarian Carcinoma

STAGING SURGERY FOR INCOMPLETE STAGING

N=77

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### Robotic Surgery for Ovarian Carcinoma

#### Patient and Intra-Op Characteristics

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## Robotic Surgery for Ovarian Carcinoma
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### Robotic Surgery for Ovarian Carcinoma

**Robotic (n=123) vs. Conversion to Laparotomy (n=13, 9.6% of attempted cases)**

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<td><strong>Range</strong></td>
<td>18-67</td>
<td>20-42</td>
</tr>
<tr>
<td><strong>SD</strong></td>
<td>6.95</td>
<td>6.57</td>
</tr>
<tr>
<td><strong>Operative Time (min)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Mean</strong></td>
<td>196.1</td>
<td>221.6</td>
</tr>
<tr>
<td><strong>Range</strong></td>
<td>66-364</td>
<td>100-499</td>
</tr>
<tr>
<td><strong>SD</strong></td>
<td>66.36</td>
<td>110.64</td>
</tr>
<tr>
<td><strong>Estimated Blood Loss (EBL-ml)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Mean</strong></td>
<td>66.6</td>
<td>295.83</td>
</tr>
<tr>
<td><strong>Range</strong></td>
<td>10-400</td>
<td>100-600</td>
</tr>
<tr>
<td><strong>SD</strong></td>
<td>58.9</td>
<td>192.4</td>
</tr>
<tr>
<td><strong>Length of Stay (hr)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Mean</strong></td>
<td>31.0</td>
<td>139.15</td>
</tr>
<tr>
<td><strong>Range</strong></td>
<td>3-122</td>
<td>47-305</td>
</tr>
<tr>
<td><strong>SD</strong></td>
<td>18.91</td>
<td>68.68</td>
</tr>
</tbody>
</table>
### Robotic Surgery for Ovarian Carcinoma

**Robotic (n=59) vs. Laparotomy (n=98)**

**EARLY STAGE DISEASE WITH FULL STAGING (Omentectomy and Lymphadenectomy)**

<table>
<thead>
<tr>
<th></th>
<th>Robotic Staging (N=59) With Nodes &amp; Omentum</th>
<th>Open Staging (N=98 ) With Nodes &amp; Omentum</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Age (yr)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>48.85</td>
<td>52.0</td>
<td>0.1123</td>
</tr>
<tr>
<td>Range</td>
<td>21-91</td>
<td>23-85</td>
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<tr>
<td>SD</td>
<td>11.75</td>
<td>11.43</td>
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</tr>
<tr>
<td><strong>BMI</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>27.8</td>
<td>30.1</td>
<td>0.0572</td>
</tr>
<tr>
<td>Range</td>
<td>18-67</td>
<td>16-52</td>
<td></td>
</tr>
<tr>
<td>SD</td>
<td>8.2</td>
<td>8.1</td>
<td></td>
</tr>
<tr>
<td><strong>Operative Time (min)</strong></td>
<td></td>
<td></td>
<td>0.0001</td>
</tr>
<tr>
<td>Mean</td>
<td><strong>218.5</strong></td>
<td><strong>148.5</strong></td>
<td></td>
</tr>
<tr>
<td>Range</td>
<td>84-364</td>
<td>79-306</td>
<td></td>
</tr>
<tr>
<td>SD</td>
<td>54.9</td>
<td>39.5</td>
<td></td>
</tr>
<tr>
<td><strong>Estimated Blood Loss (EBL-ml)</strong></td>
<td></td>
<td></td>
<td>0.0001</td>
</tr>
<tr>
<td>Mean</td>
<td>65.8</td>
<td>232.8</td>
<td></td>
</tr>
<tr>
<td>Range</td>
<td>10-400</td>
<td>50-1000</td>
<td></td>
</tr>
<tr>
<td>SD</td>
<td>59.85</td>
<td>165.9</td>
<td></td>
</tr>
<tr>
<td><strong>Length of Stay (hr)</strong></td>
<td></td>
<td></td>
<td>0.0001</td>
</tr>
<tr>
<td>Mean</td>
<td>28.5</td>
<td>88.03</td>
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<tr>
<td>Range</td>
<td>15-90</td>
<td>42-291</td>
<td></td>
</tr>
<tr>
<td>SD</td>
<td>12.1</td>
<td>43.3</td>
<td></td>
</tr>
</tbody>
</table>
## Robotic Surgery for Ovarian Carcinoma

Robotic (n=59) vs. Laparotomy (n=98)

**EARLY STAGE DISEASE WITH FULL STAGING (Omentectomy and Lymphadenectomy)**

<table>
<thead>
<tr>
<th></th>
<th>Robotic Staging (N=59) With Nodes &amp; Omentum</th>
<th>Open Staging (N=98) With Nodes &amp; Omentum</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>TOTAL Lymph Nodes</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>13.12</td>
<td>12.63</td>
<td>0.3977</td>
</tr>
<tr>
<td>Range</td>
<td>3-40</td>
<td>2-43</td>
<td></td>
</tr>
<tr>
<td>SD</td>
<td>7.54</td>
<td>8.39</td>
<td></td>
</tr>
<tr>
<td><strong>Pelvic Lymph Nodes</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>10.0</td>
<td>10.22</td>
<td>0.9557</td>
</tr>
<tr>
<td>Range</td>
<td>2-36</td>
<td>2-33</td>
<td></td>
</tr>
<tr>
<td>SD</td>
<td>6.5</td>
<td>6.87</td>
<td></td>
</tr>
<tr>
<td><strong>Peri-Aortic Lymph Nodes</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>4.36</td>
<td>3.4</td>
<td>0.0063</td>
</tr>
<tr>
<td>Range</td>
<td>0-12</td>
<td>1-13</td>
<td></td>
</tr>
<tr>
<td>SD</td>
<td>2.7</td>
<td>2.56</td>
<td></td>
</tr>
</tbody>
</table>
Robotic Surgery for Ovarian Carcinoma

Conclusions

Robotic surgery appears preliminarily feasible for surgical staging of ovarian cancers *in a carefully selected patient population*

Complications were acceptable, and EBL/LOS were low

Nodal yields appear preliminarily acceptable

Conversion rates were higher than our early series (9.6% vs. 2.9%), suggesting limitations in applicability

Limitations to completion in our series included bowel involvement, disseminated disease, tumor size, and dense adhesive disease
Robotic Surgery for Ovarian Carcinoma

Questions

Is false-negative rate increased with minimally invasive surgery vs. open surgery?

Can chemotherapy or other adjuvant therapies begin earlier after minimally invasive surgery?

Will neo-adjuvant chemotherapy increase utilization of minimally invasive techniques in women undergoing surgery (INTERVAL CYTOREDUCTION) for ovarian cancer?

How much is society willing to pay for improvements in quality-of-life for cancer patients?

Can this technology be applied more broadly to surgery in patients with advanced stage disease or recurrent disease?
Robotic Surgery for Ovarian Carcinoma

What’s Next?

Long term oncologic outcomes
– Impact of faster recovery

Quality of life outcomes

Cost effectiveness of robotic surgery
– Are high fixed costs/maintenance/additional consumables offset by
  • Reduction in postop hospital costs
  • Reduction in costly, often poorly reimbursed postop complications
  • Productivity gains for patients returning significantly earlier to work
Robotic Surgery for Ovarian Carcinoma
Evolution of Treatment & The Future

Laparotomy for Adnexal masses

Laparoscopy for BENIGN-appearing adnexal masses

Laparoscopy for suspicious Adnexal masses; conversion To laparotomy if malignant

Minimally invasive surgery
For diagnosis AND staging of Probable early stage ovarian cancer

Minimally invasive Treatment of advanced stage ovarian cancer; upper abdominal & bowel resections
VULVAR CANCER: “Less is more”:

Reduction in Lymphadenectomy Morbidity with Sentinel Lymph Node Dissection
Sentinel Node Dissection Is Safe in the Treatment of Early-Stage Vulvar Cancer

Ate G.J. Van der Zee, Maudke H. Oonk, Joanne A. De Hulst, Anna C. Ansink, Ignace Vergote, René H. Verheijen, Angela Muggioni, Karja N. Gaarenstroom, Peter J. Baldews, Eleonore B. Van Dorsse, Jacobus Van der Velden, Ralph H. Hermans, Hans van der Putten, Pierre Drouin, Achim Schneider, and Wim J. Sluiter

ABSTRACT

Purpose
To investigate the safety and clinical utility of the sentinel node procedure in early-stage vulvar cancer patients.

Patients and Methods
A multicenter observational study on sentinel node detection using radioactive tracer and blue dye was performed in patients with T1/2 (< 4 cm) squamous cell cancer of the vulva. When the sentinel node was found to be negative at pathologic ultrastaging, inguinofemoral lymphadenectomy was omitted, and the patient was observed with follow-up for 2 years at intervals of every 2 months. Stopping rules were defined for the occurrence of groin recurrences.

Results
From March 2000 until June 2006, a sentinel node procedure was performed in 623 groins of 403 assessable patients. In 259 patients with unifocal vulvar disease and a negative sentinel node (median follow-up time, 36 months), six groin recurrences were diagnosed (2.3%; 95% CI, 0.6% to 5%), and 3-year survival rate was 97% (95% CI, 91% to 99%). Short-term morbidity was decreased in patients after sentinel node dissection only when compared with patients with a positive sentinel node who underwent inguinofemoral lymphadenectomy (wound breakdown in groin: 11.7% v 34.0%, respectively; P < .0001; and cellulitis: 4.5% v 21.3%, respectively; P < .0001). Long-term morbidity also was less frequently observed after removal of only the sentinel node compared with sentinel node removal and inguinofemoral lymphadenectomy (recurrent erysipelas: 0.4% v 16.2%, respectively; P < .0001; and lymphedema of the legs: 1.9% v 25.2%, respectively; P < .0001).

Conclusion
In early-stage vulvar cancer patients with a negative sentinel node, the groin recurrence rate is low, survival is excellent, and treatment-related morbidity is minimal. We suggest that sentinel node dissection, performed by a quality-controlled multidisciplinary team, should be part of the standard treatment in selected patients with early-stage vulvar cancer.

J Clin Oncol 26:884-889. © 2009 by American Society of Clinical Oncology
### Table 2. Short- and Long-Term Morbidity After SLN Procedure Alone Compared With SLN With Subsequent Inguinofemoral Lymphadenectomy

<table>
<thead>
<tr>
<th>Morbidity</th>
<th>SLN Dissection Only</th>
<th>SLN Dissection Plus Lymphadenectomy</th>
<th>( P )</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Short term</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total No. of patients</td>
<td>264</td>
<td>47*</td>
<td></td>
</tr>
<tr>
<td>Wound breakdown, groin</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No. of patients</td>
<td>31</td>
<td>16</td>
<td>&lt; .0001</td>
</tr>
<tr>
<td>%</td>
<td>11.7</td>
<td>34.0</td>
<td></td>
</tr>
<tr>
<td>Cellulitis</td>
<td></td>
<td></td>
<td>&lt; .0001</td>
</tr>
<tr>
<td>No. of patients</td>
<td>12</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>%</td>
<td>4.5</td>
<td>21.3</td>
<td></td>
</tr>
<tr>
<td>Hospital stay, days</td>
<td>8.4</td>
<td>13.7</td>
<td>&lt; .0001</td>
</tr>
<tr>
<td><strong>Long term</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total No. of patients</td>
<td>264</td>
<td>119†</td>
<td></td>
</tr>
<tr>
<td>Lymphedema</td>
<td></td>
<td></td>
<td>&lt; .0001</td>
</tr>
<tr>
<td>No. of patients</td>
<td>5</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td>%</td>
<td>1.9</td>
<td>25.2</td>
<td></td>
</tr>
<tr>
<td>Recurrent erysipelas</td>
<td></td>
<td></td>
<td>&lt; .0001</td>
</tr>
<tr>
<td>No. of patients</td>
<td>1</td>
<td>19‡</td>
<td></td>
</tr>
<tr>
<td>%</td>
<td>0.4</td>
<td>16.2</td>
<td></td>
</tr>
</tbody>
</table>
NCNN Guidelines Version 1.2017
Vulvar Cancer (Squamous Cell Carcinoma)

PRINCIPLES OF SURGERY: INGUINAL/FEMORAL SENTINEL LYMPH NODE BIOPSY

- Unilateral or bilateral inguinal lymphadenectomy is associated with a high rate of postoperative morbidity; 20%-40% of patients are at risk for wound complications and 30%-70% of patients are at risk of lymphedema.14
- Increasing evidence suggests that the use of SLN biopsy of the inguinal/femoral LN basin is an alternative standard-of-care approach to lymphadenectomy in select women with squamous cell carcinoma of the vulva.15,16
- SLN biopsy results in decreased postoperative morbidity without compromising detection of LN metastases.15,17
- Prospective, cooperative group trials have evaluated the SLN technique and demonstrate feasibility, safety, validity, and a low risk of groin recurrences with this surgical approach in vulvar cancer.15,16
- Candidates for SLN biopsy include patients with negative clinical groin examination and imaging, a primary unilocal vulvar tumor size of ≤4 centimeters, and no previous vulvar surgery that may have impacted lymphatic flow to the inguinal region.16,18
- If SLN biopsy is contraindicated, it ideally should be performed by a high-volume SLN surgeon, as high-volume surgeons exhibit improved SLN detection rates.16
- Increased sensitivity of SLN detection is observed when both radiocolloid and dye are used.15,16,17 The radiocolloid most commonly injected into the vulvar tumors is technetium-99m sulfur colloid. It is most commonly injected 2-4 hours prior to the vulvectomy and lymphadenectomy procedure. A preoperative lymphoscintigraphy may be performed to aid in anatomically locating the sentinel node. The dye most commonly used is isosulfan Blue 1%. Approximately 3-4 cc of dye is injected peritumorally using a four-point injection technique at 2, 5, 7, and 10 o’clock. The dye is injected intradermally in the operating room within 15-30 minutes at initiating the procedure.
- It is recommended that the SLN procedure is performed prior to the excision of the vulvar tumor, so as not to disrupt the lymphatic network between the primary vulvar tumor and the inguinal LN basin. Additionally, the injected blue dye will only transiently localize (ie, for 20-60 minutes) in the first group of nodes that correspond to the primary vulvar tumors.
- Use of a gamma probe to detect the injected radiocolloid within the inguinal/femoral region is recommended prior to making the groin incision in order to tailor the location and size of the incision.
- A complete inguinal/femoral lymphadenectomy is recommended if an ipsilateral SLN is not detected.
- The management of positive SLNs is currently being evaluated and may include performance of complete inguinal/femoral lymphadenectomy and/or administration of adjuvant radiation to the affected groin(s).
- If ipsilateral SLN is positive, the contralateral groin should be evaluated surgically and/or treated with EBRT.
Surgical and medical therapy of gynecologic cancers continues to evolve in order to minimize resultant morbidity and mortality, and increased attention to preservation of fertility where appropriate.
PRIMUM NON NOCERE
Less IS More
Thank You!