Efficacy of new surgical techniques

S. GORDTS

ESHRE-ASRM
Cortina d' Ampezzo.

Conflict of interest: cons. Storz

Gynecological Reproductive Surgery

"Minimal invasive"

20th Century:
1970-1980: Microsurgery
1980 – 1990: Laparoscopy

21st Century:
Robotics
Laparoscopic endoscopic single site surgery (LESS)

NOTES

Abdominal hysterectomies: 70 – 80 %

Laparoscopic surgery in gynecology

- long learning curve
- long instruments
- different tactile sensation
- fixed entry points
- difficult control movements
- 2-D image

Only reason?? << surgeons
Sutureless laparoscopic anastomosis
Schepens et al.
Hum Reprod 2011

Technique
- Infiltration mesosalpinx epinephrine
- Excision
- Guiding catheter
- 3mm microstaplers
- Tissuecol
- Removal catheter after 4 h

N=127 CPR 40 months 74%
- IUP 59%
- Ectopic 3.5%

ROBOTICS
Objectives:

- To improve the surgeon’s capabilities through technology
- To overcome the limitations of human performance
ROBOTICS

“Robotics allows less experienced surgeons to perform more complex procedures.”

No randomized controlled trials
Comparative observational studies

ROBOTICS

No training
High costs (estim 3000 € / procedure)
Yearly maintenance
Added value???

Robotically assisted laparoscopic microsurgical tubal reanastomosis: a retrospective study.
Caillet M, Vandromme J. et al.
Fertil Steril, 2010,94
Number : 79 mean age: 37 y   PR: 71%   BR: 62%

<table>
<thead>
<tr>
<th>Age Group</th>
<th>Pregn. Rate</th>
<th>Birth Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;35</td>
<td>91%</td>
<td>88%</td>
</tr>
<tr>
<td>36 – 39 y</td>
<td>75%</td>
<td>66%</td>
</tr>
<tr>
<td>40 – 42 y</td>
<td>50%</td>
<td>43%</td>
</tr>
<tr>
<td>&lt;45 y</td>
<td>33%</td>
<td>8.3%</td>
</tr>
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Robotic treatment of colorectal endometriosis: technique, feasibility and short-term

Ercoll A., D’Asta M, Fagotti A. et al.

Hum Reprod. 2012 Jan 11. [Epub ahead of print]

Number: 22 patients
12 segmental resection
10 shaving technique
No complications

ROBOTICS

GOOD EVIDENCE:
facilitates laparoscopic surgery
shorter operating times?
comparable surgical results
shorter hospital stays
few major complications

SILS

Laparoscopy

NOTES

SPA single port access
TUES transumbilical endoscopic surgery
NOTUS Natural Orifice Trans Umbilical Surgery
NOTES

- Natural Orifice Transluminal Endoscopic Surgery
- Mouth => transgastric
- Vagina => transvaginal
- Anus => transrectal
- Urethra => transvesical

N.O.T.E.S: Advantages

- No scar – no visible scar
- No skin infection (mucosa)
- No abdominal incision
- No incisional hernia
- Less physiological stress?
- Faster recovery?

Today’s challenges

- Optimal access
- Retraction / exposure
- Instruments
- Lack of triangulation
- Orientation
- Suturing
- Closure
- Need for a specialized training or specialty
Capacitive coupled current from activated scissors to suction cannula

Abu-Rafea B et al. JMG 2011, 16:734-40

Transvaginal Endoscopy
Possibilities of operative procedures at transvaginal access

Ovarian capsule drilling

Endometriosis: peritoneal & ovarian

Surgical treatment of patients with PCO related infertility

Transvaginal laparoscopic ovarian capsule drilling

Easy; low morbidity
Minimal trauma
Watery environment
Surgical treatment of patients with PCO related infertility

Wedge resection (Stein-Leventhal, 1935)

Laparoscopic procedures
  biopsy
  electrocautery
  laser

Transvaginal laparoscopic procedures
  bipolar current

Mean preg. rate: 63%

Risks ovarian drilling:

Laparoscopy related risks
  (mortality 1/12,000; morbidity 2-3/1000)

Adhesion formation

Degeneration ovary

Strategy

Diet
  Clomiphene citrate

Ovulation induction FSH
  Drilling ovarian capsule
## Surgical treatment of patients with PCO related infertility

### Adhesion formation

<table>
<thead>
<tr>
<th>Study</th>
<th>n</th>
<th>Procedure</th>
<th>Rate</th>
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</thead>
<tbody>
<tr>
<td>Naether; Fisher (1993)</td>
<td>62</td>
<td>Cauterisation</td>
<td>19%</td>
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<tr>
<td>Naether et al. (1994)</td>
<td>26</td>
<td>Cauterisation</td>
<td>27%</td>
</tr>
<tr>
<td>Liquori et al. (1996)</td>
<td>30</td>
<td>Cauterisation</td>
<td>23%</td>
</tr>
<tr>
<td>Tekedjian et al. (2000)</td>
<td>15</td>
<td>Cauterisation</td>
<td>20%</td>
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<tr>
<td>Gorgun et al. (1996)</td>
<td>15</td>
<td>Cauterisation</td>
<td>26%</td>
</tr>
<tr>
<td>Weise et al. (1996)</td>
<td>10</td>
<td>Cauterisation</td>
<td>23%</td>
</tr>
<tr>
<td>Groshaus (1999)</td>
<td>30</td>
<td>Nd:Yag laser</td>
<td>3%</td>
</tr>
<tr>
<td>Weise et al. (2000)</td>
<td>11</td>
<td>Nd:Yag laser</td>
<td>0%</td>
</tr>
<tr>
<td>Gürgan et al. (1992)</td>
<td>20</td>
<td>Nd:Yag laser</td>
<td>68%</td>
</tr>
<tr>
<td>Groshaus (1998)</td>
<td>19</td>
<td>CO2 laser</td>
<td>15%</td>
</tr>
</tbody>
</table>
Easy, low morbidity
Minimal trauma
Watery environment

Findings after first TV drilling

Risks adhesion formation
A prospective dose-finding study of the amount of thermal energy required for laparoscopic ovarian diathermy
S.A.K. Amer, T.C. Li and I.D. Cooke
Human Reproduction Vol.18, 2003

- Four, three, two, one punctures/ovary
- Ovulation occurred in
  67, 44, 33 and 33%
- Corresponding pregnancy rates:
  67, 56, 17 and 0%
Comparison between LOD and THL

<table>
<thead>
<tr>
<th></th>
<th>Laparoscopic</th>
<th>THL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy</td>
<td>monopolar</td>
<td>bipolar</td>
</tr>
<tr>
<td>Needle diameter</td>
<td>2mm</td>
<td>0.2mm</td>
</tr>
<tr>
<td>Puncture</td>
<td>4</td>
<td>10-15</td>
</tr>
<tr>
<td>Power setting</td>
<td>30W</td>
<td>70W</td>
</tr>
<tr>
<td>Duration</td>
<td>5 sec</td>
<td>10 sec</td>
</tr>
</tbody>
</table>

Results according to infertility duration

<table>
<thead>
<tr>
<th>Years of infertility</th>
<th>Nb</th>
<th>Ovulation</th>
<th>Pregn. rate</th>
</tr>
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<tbody>
<tr>
<td>&lt; 3 years</td>
<td>90</td>
<td>88 %</td>
<td>72 %</td>
</tr>
<tr>
<td>3-6 years</td>
<td>83</td>
<td>76 %</td>
<td>33 % *</td>
</tr>
<tr>
<td>&gt; 6 years</td>
<td>23</td>
<td>52 % *</td>
<td>18 % *</td>
</tr>
</tbody>
</table>

*p<0.05  Watrelot et al.

Results of ovarian drilling

Peking University Third Hospital
Caihong Ma, M.D. Ph.D.

- 45 subjects (Jan 2008 to Jan 2010)
- Seven patients were lost for follow-up
- Average age 28.3 ± 3.0 yr
- Infertility time 43 ± 38 months
- BMI 24 ± 3kg/m²
Results of ovarian drilling
Peking University Third Hospital
Caihong Ma, M.D. Ph.D.

<table>
<thead>
<tr>
<th>RESUMED OVULATION</th>
<th>20/38</th>
<th>52.6%</th>
</tr>
</thead>
<tbody>
<tr>
<td>IN VIVO PREGN. RATE</td>
<td>18/38</td>
<td>47.36 %</td>
</tr>
<tr>
<td>SPONTANEOUS CONCEPTION</td>
<td>12/38</td>
<td>31.57 %</td>
</tr>
</tbody>
</table>

PCO: DRILLING BY TRANSVAGINAL LAPAROSCOPY

<table>
<thead>
<tr>
<th>N</th>
<th>Pregnancy rate</th>
<th>Mean time (months)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fernandez 2001</td>
<td>23</td>
<td>62%</td>
</tr>
<tr>
<td>Casa 2005</td>
<td>28</td>
<td>38 %</td>
</tr>
<tr>
<td>Fernandez 2004</td>
<td>74</td>
<td>70 %</td>
</tr>
<tr>
<td>Shibahara 2006</td>
<td>7</td>
<td>51 %</td>
</tr>
</tbody>
</table>

Leuven Institute for Fertility & Embryology
An economic comparison of a laparoscopic electrocautery strategy and ovulation induction with recombinant FSH in women with clomiphene resistant polycystic ovary syndrome. Van Wely et al. Fertil Steril 2004;19

Consensus on infertility treatment related to polycystic ovary syndrome. ESHRE/ASRM PCOS consensus workshop. Fertil Steril 2008; 89

First line: clomiphene; second line: ovarian drilling or gonadotrophines; third line: IVF

Porcine ovary
Evaluation of the tissue damage of porcine ovaries after bipolar drilling under transvaginal hydrolaparoscopy. Ma CH, Gynecol Endocrinol. 2010

Tissue damage bipolar <= monopolar
Caihong Ma, M.D. Ph.D.

- The monopolar drilling caused more tissue damage than the bipolar needle (P<0.01)
- The ratio of the tissue damage of monopolar electrocoagulation (40w, 3s) over that of bipolar diathermy (70w, 15s) was 7.4
  
  \[
  \frac{16.74 \pm 1.30}{2.27 \pm 0.49} \text{ mm}^3
  \]
Tissue damage
bipolar >> monopolar

- In the bipolar groups, the 70w power setting caused significantly more tissue damage than the 50w ones (P<0.05)
- However, at 70W setting, the duration of puncture (10s, 15s and 20s) did not make any difference to the amount of tissue damage

Summary

- For now, ovarian drilling via THL -- bipolar diathermy needle, 70W, 10-15 punctures, 10 sec
- The results of ovarian drilling via THL produces results similar to LOD
- Dose-finding studies are needed to improve the results of ovarian drilling via THL
TECHNIQUES FOR RECONSTRUCTIVE OVARIAN SURGERY IN ENDOMETRIOSIS

Residual ovarian volume after surgery

<table>
<thead>
<tr>
<th>Endometriosis</th>
<th>Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.1 ± 3.2*</td>
<td>6.7 ± 3.3*</td>
</tr>
</tbody>
</table>

Treated | Control | Treated | Control |
<table>
<thead>
<tr>
<th></th>
<th></th>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>4.3 ± 2.9*</td>
<td>9.7 ± 3.9*</td>
<td>7.1 ± 3.5*</td>
<td>8.3 ± 3.1</td>
</tr>
</tbody>
</table>


Decline of AMH after cystectomy for ovarian endometrioma

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Overall (n=38)</th>
<th>Unilateral (n=20)</th>
<th>Bilateral (n=18)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>33.8 ± 4.7</td>
<td>34.0 ± 3.9</td>
<td>33.6 ± 5.4</td>
<td>0.830</td>
</tr>
<tr>
<td>BMI (kg/m²)</td>
<td>20.1 ± 2.3</td>
<td>20.4 ± 2.7</td>
<td>19.7 ± 1.7</td>
<td>0.781</td>
</tr>
<tr>
<td>Pre-operative</td>
<td>3.9 ± 2.5</td>
<td>4.1 ± 2.3</td>
<td>3.6 ± 2.7</td>
<td>0.299</td>
</tr>
<tr>
<td>Post-operative</td>
<td>2.1 ± 1.6</td>
<td>2.9 ± 1.6</td>
<td>1.2 ± 1.0</td>
<td>0.001</td>
</tr>
</tbody>
</table>

Hirakawa et al. Hum Reprod 2012; 20: 4
The Myometrial Junctional zone
Adenomyosis: Minimal invasive diagnosis?

2D TVS
Accuracy: 83%
Sensitivity: 75%

3D TVS (coronal view)
Accuracy: 89%
Sensitivity: 91%

Junctional Zone Myometrium
Functional important entity in reproduction
- Ontogenetically related to endometrium
- Cyclic changes in SSH receptors
- Role in gamete transport and implantation

Junctional Zone Myometrium
Important role in Reproduction
Functional important entity in reproduction
- Early changes from time of implantation
- Decidualization and trophoblast invasion
- Defective transformation of JZ spiral arteries in spectrum of pregnancy complications
- Preterm rupture membranes
- Preterm delivery
The Myometrial Junctional zone

**JZ myometrium is a distinct uterine structure**

- More akin to the endometrium than outer myometrium
- Like the endometrium, the JZ is of Müllerian origin, while the outer myometrium is of non- Müllerian, mesenchymal origin (Noe et al. 1999)
- The JZ but not outer myometrium undergoes cycle-dependent changes
- Uterine peristaltic activity originates exclusively from the JZ while the outer myometrium remains quiescent throughout the cycle

MRI

New challenges to uterine diagnosis

MRI has demonstrated the importance of JZ pathology.

*Uterine diagnosis should implement the evaluation of the JZ myometrium.*

**HOW?**

As MRI can not be implemented as a screening procedure we explore the value of US and HSC?

Subtle lesions sign of JZ Pathology?

- Abnormal endometrial images with an unclear clinical significance
- Subtle lesions possibly related to adenomyosis
  - Strawberry pattern
  - Cystic mucosal elevation
  - Focal or general hypervascularisation
  - Endometrial defects
New Tools for Myometrial Exploration

Spirotome

A device made to harvest high quality samples from soft tissues.
It is built on the pioneering concept of a cutting helix on a cutting canula
well identified by Ultrasound.
Reproductive Surgery

What should be achieved and can I do it?

- It is better to do no surgery than to do bad surgery

- Stopping the procedure and further referral of patient is not a medical fault or failure

Training

See one, do one, teach one

- Situation:
  - Introduction 80 hours workweek
  - More paperwork than surgical interventions
  - Decrease of surgical volume, because of less invasive procedures
Training

See one, do one, teach one

Solutions:
- Extend the years
- Use of simulators
- Mental practice training: specific cognitive imaging

Leuven Institute for Fertility & Embryology

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Rudi Campo
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Marion Valkenburg
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