Operative Hysteroscopy: The Essentials

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• Hologic, AMS: Advisory Panel


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Objectives

• Review the role of operative hysteroscopy in the management and treatment of abnormal uterine bleeding

• Traditional and emerging new techniques to facilitate complete dissection are reviewed

• Outcomes are tabulated
Case Study

• MK is a 46 yo G0
  – 2 yr month history of excessive bleeding
  – Her quality of life is poor due to unpredictable menses,
    – Gushing, clots the size of “oranges”
  – Severe dysmenorrhea only when passing large clots
  – Cycles previously regular every 28-30 days, lasting 7-8 days, however within past 6 months bleeds 22/30 days monthly and unpredictable
    – Sometimes has post coital bleeding
    – Decreases scheduled activities with cycle
    – Afraid of the new airline requirements of remaining seated during last hour of a flight
Case Study

• Her local gynecologist performed a D&C 3 months ago without any improvement in her symptoms
• Recommended another D&C
• She is coming to you for a second opinion
Case Study

- **PMH**
  - Non contributory

- **NSAIDs for dysmenorrhea**

- **Family Hx:**
  - Mother “had fibroids” and had a hysterectomy with numerous post op complications

- **Labs**
  - Hgb 6.5/Hct 25.2, nl plts
  - Normal TSH
  - VWD panel negative
  - Pap negative
Case Study

• Prior evaluation
  – Endometrial biopsy performed by D&C revealed proliferative endometrium

• Tried a Mirena intrauterine system after the D&C and it was expelled within one month after placement

• She is not interested in future childbearing, but wishes to avoid hysterectomy

• Seeking your “second opinion” advice
Case Study

• Saline infusion ultrasound demonstrated a 4 cm intracavitary fibroid, Type 0

• What concerns do you have regarding hysteroscopic resection of this fibroid?
  – What aspects of informed consent would you relay to the patient?

• What surgical principals should you follow during surgery?
Cases: Additional Musings

• What if imaging confirmed an 8 cm intracavitary fibroid?

• What if imaging confirmed a 1, 3, 5, or 6 cm Type 1 myoma
  — A type 2 myoma?

• What do you do if you must stop the procedure prior to completion?
Widespread Impact

In the United States, abnormal uterine bleeding affects more than 30 of every 100 women between the ages of 35 and 49.
Leiomyomas

- Rarely malignant
- More common in African Americans
- Associated with abnormal bleeding, recurrent miscarriage and infertility

- Often missed on routine D&C
- Very well imaged with hysteroscopy and saline infusion sonography (SIS)
- Submucosal fibroids may account for 15-25% of all fibroids
Symptoms: Menstrual Aberrations

- Heavy prolonged menses
- Chronic bloody or non bloody discharge
- Premenstrual staining
- Post-coital bleeding
- Anemia (pica)
- Anovulatory cycles can co-exist with fibroids

In a typical fibroid population 85% patients complained of abnormal uterine bleeding and this was the major fibroid related symptom in 64% of patients.
Why Do Fibroids Bleed?

• Vascularization
  – Increased vessel number??
  – Decreased vessel function??
• Increased endometrial surface area
• Impede uterine contractions
• Uterine contents not expelled efficiently
• More expandable venules with less efficient clotting
Indications for Hysteroscopic Myomectomy

- Menorrhagia
- Dysmenorrhea
- Recurrent pregnancy loss
- Stubborn bleeding on hormone replacement therapy
- Pelvic pain
- Constant discharge/leukorrhea
- Evaluation of uterine cavity after vaginal myomectomy
- Infertility
Hysteroscopic Myomectomy Contraindications

- Inexperienced surgeon
- Pregnancy
- Physician unfamiliar with equipment
- Acute pelvic infection
- Genital tract malignancy
- Lack of informed consent
- Completely intramural or subserosal
- Myoma >3 cm and > 50% within the myometrium
- If a large portion of the endometrial cavity will be removed in a patient desiring fertility
Endometrial Polyps

• Common throughout reproductive life

• Account for 6.8-50% cases of irregular bleeding between 20-40 yrs.

• Increases each decade

• Frequent cause of postmenopausal bleeding

• Most polyps are benign

• Associated symptoms
  – Watery discharge
  – Intermenstrual staining
  – Dysmenorrhea
  – Prolapse
  – Post coital bleeding

• Usually single

• Increased incidence in Tamoxifen users
Indications for Polypectomy

- Metrorrhagia
- Post coital bleeding
- Intermenstrual staining
- Discharge
- IVF candidates
- Found coincidentally with intra-cavitary fibroids
- Risk of malignancy
Polypectomy

• Complete resection essential
• Remnants may be associated with continued menstrual irregularity
• Low risk of malignancy (<2%)
• May co-exist with other pathology
Retained Products of Conception

• Retained products may cause
  – Menstrual disturbances
  – Infertility
  – Synechiae

• Can ultrasound help?

• Can operative hysteroscopy help when patient has had prior suction D&C without resolution of menstrual dysfunction?
Retained Products of Conception

• Is medical abortion complete?
  – Yes, if pt. is asymptomatic and a well defined endometrial echo is < 15 mm is evident

• When patient is:
  – Symptomatic, endometrial echo is > 15 mm, and endometrium is hyper-echogenic, then suspect retained products of conception

Retained Products of Conception (RPOC)

• In symptomatic patients RPOC was reliably detected when TVUS > 15 mm

• TVUS criteria had a 100% sensitivity and a 98.7% specificity for recognition of RPOC.

• Positive and negative predictive factors were 91.3% and 100%

• Suspected RPOC found in 4% of asymptomatic patients and confirmed by diagnostic hysteroscopy in 86%

Operative Hysteroscopy in Women with Retained Products of Conception

• Same principles as hysteroscopic resection of myomas/polyps
• Often products of conception are necrotic and friable
• May be able to use the wire loop, without electricity to manually scrap off retained products of conception
• Excellent direct visualization with this technique and can determine that complete removal has occurred
The Importance of Pre-Operative Assessment

• To exclude malignancy and predict likely pathology

• To help decide what technology is appropriate

• To determine if endometrial ablation is appropriate

• To determine whether a global or hysteroscopic procedure is desirable

Imaging

• Remember that office hysteroscopy and Saline Infusion Sonography are complementary in identifying intracavitary lesions

• Hysteroscopy is less accurate in detecting myomas with deep intramural extension (Class II myomas)

• Saline infusion sonography permits adnexal, bladder imaging, and determination of depth of penetration of leiomyoma

Hysteroscopic Classification System
(European Society)
The straight catheter is inserted to the fundus.

In the case of an anteverted uterus the ultrasound wand touches the uterus through the anterior vaginal wall. In the case of a retroverted uterus it would be inserted against the posterior vaginal wall.

C. A 10 ml syringe of normal saline (or 1% lidocaine when local anesthesia is required and there is no allergy) is attached to the catheter after removal of the speculum.
What Else Do I Want to Know On the Day of
Hysteroscopic Surgery?

- Last menstrual period
- Herpes prodrome?
- Did she remember to take Cytotec?
- Does she plan on having children?
- Surgical Time Out?
  - Right patient?
  - Right procedure?
  - Instruments needed all present?
  - Informed consent and complications reviewed with patient
- Anesthesiologist
Operative Hysteroscopy: Technical Considerations

- Operate during early proliferative phase or with endometrial thinning
- Attempt resection of Type 0 and 1 fibroids only
- Always advance the electrode towards yourself

- Visualize all landmarks throughout the case
- Restrict resection to endometrial surfaces
  - if deep intramural lesion noted--be patient!! Often once the pseudocapsule is breached, the uterus will contract and expel the myoma into the field
  - intermittently decrease intra uterine pressure to prevent “disappearing phenomenon”

- Beware of progressive myometrial eversion
- End resection at capsular level
- Uterine decompression ---and wait--reinspect
General Principles of Operative Hysteroscopic Myomectomy

- Deflate the endometrium as you resect
- Uterine massage
- Reinspect endometrial cavity 2-3 minutes after removing hysteroscope
- Endometrial suppression not needed, try to schedule post-menses or early proliferative phase
- Sharp curettage can be performed if copious endometrial debris, blood, or copious endometrium

- Consider post op office hysteroscopy in patients desiring fertility within 7-10 days
  - Consider estrogen therapy to aid in re-epithelialization of endometrium in patients desiring fertility
  - Or placement of a 30 mL intrauterine foley catheter
Intrauterine Surgical Techniques

• Resectoscopic Myomectomy
  – consider oral, vaginal misoprostol or laminaria in nulliparous, multiple C/S, menopausal, or those with prior cone biopsies, since cervix must be dilated to 22F-31 F with hysteroscope

  – use concomitant laparoscopy if concerned about perforation

  – use of dilute solution of pitressin intracervically (to decrease absorption of fluid and facilitate cervical dilation) 20u/100ml saline
Intrauterine Surgical Techniques

- Know your landmarks
- Movement
  - Move wrists
  - Move your hysteroscope
- Vary the intrauterine pressure
- Open and close outflow valve when needed
- Remove clots and debris when poor visualization occurs
Operative Hysteroscopy: Toolkit

- Ovum forceps
- Polyp forceps
- Ring forceps
- Myoma (Corson) graspers
- Suction curette
- Sharp curette
- Cutting loop
Intra-operative safety precautions

- Flat
  - Do not use Trendelenberg
- Position legs in Allen stirrup’s or Candy cane
- Collect fluids with drapes/pouches
- Monitor end tidal CO2
- Watch light sources
Fluid Pumps: Use Them!!!
Fluid balance is an important issue during hysteroscopy!

But it's really difficult to track!

...especially the amount on the floor.
Tracking Glycine Irrigation Fluid Intraoperatively

• When asked to estimate amount of fluid on the floor, experienced OR nurses had a difficult time, commenting: "we are totally unable to estimate the amount of fluid on the floor".
Puddle Vac  AKA “Sucky Ducky”
How Big of an Intracavitary Fibroid Can You Tackle?

• Issues
  – Fluid absorption
  – Chip management
  – Navigation within the uterine cavity
  – Uterine walls collapsing
  – Cervix
Size of Intracavitary Lesion Determines Surgical Time

• As diameter of myoma increases, volume increases cubically \( v = \frac{4}{3} \pi r^3 \), increasing operating time

• Surgeons should be aware of this dynamic and plan accordingly for overall procedure time

*Surgery Time vs. Size*

*Emanuel, MH. (2005). Presentation to Smith & Nephew*
Remember Volume

- $4/dr^3$
- $1 \text{ cm} = \frac{1}{2} \text{ cubic cm tissue}$
- $2 \text{ cm} = 4 \text{ cubic cm tissue}$
- $3 \text{ cm} = 14 \text{ cubic cm tissue}$
- $4 \text{ cm} = 33 \text{ cubic cm tissue}$

As you increase the size of the lesion for operative hysteroscopy, the volume of Resected tissue dramatically increases.

This affects length of surgery, amount of fluid used, and ability to complete the surgery.
Cytotec: Use It

• Misoprostol (cytotec)
  – Synthetic methyl analogous of PGE$_2$
  – Acts on cellular matrix, dissolving collagen, increases hyaluronic acid, increased cervical water by increasing vascularity permeability
  – Interleukin-8 is affected, increasing collagenase and thus cervical softening
  – Activates smooth muscle contractions

Cytotec: Use It

- Studies demonstrate
  - 100, 200, 400 mcg (micrograms)
  - Sublingual, oral, vaginal, or rectal helpful

- Rapid absorption orally
  - Peak plasma levels in 30-60 minutes
  - 85% bound to proteins
  - 90% excretion in 8 hrs (64% kidneys, 15% feces)
  - Bioavailability of vaginally administered misoprostol is 3 times higher than by mouth
Cytotec: Use It

• Side effects
  – Genital bleeding, pain, diarrhea, vomiting

• Facilitates cervical dilation, reduces pain, and decreases complications of hysteroscopy

• Increases myometrial contractility facilitating full enucleation

Use Cytotec: It Works

• Options
  – Cytotec 200-400 mcg by mouth or intra-vaginally at bedtime prior to procedure
  – If very tight cervix suspected, then begin above regimen 2 days before procedure as well as at bedtime prior to procedure

Consider Vasopressin

• Preparation: 20 u/100 saline = 0.2 u/cc

• Direct intra-cervical stromal injection of 5 mL at 12, 3, 6 and 9 o’clock
  – Alert anesthesiologist
  – Aspirate before injection
  – Administer 5 cc/side = 4 units
  – Assess for cardiovascular response before second injection
## Intracervical Vasopressin Effects During Operative Hysteroscopy


N=106

<table>
<thead>
<tr>
<th>Measurement</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>BLOOD LOSS</td>
<td>&lt; .05</td>
</tr>
<tr>
<td>INTRAVASATION</td>
<td>&lt; .05</td>
</tr>
<tr>
<td>OPERATING TIME</td>
<td>&lt; .05</td>
</tr>
</tbody>
</table>
Hysteroscopic Instrumentation

- **Telescope**
- **Sheath System**
  - Hysteroscope
    - Diagnostic
    - Operative
  - Resectoscope
Gyne-Pro™
Hysteroscopy Electrodes

Coagulating Resector
Perforated Roller
GYNECARE VERSAPOINT Bipolar Electrodes: Utilizing Saline

Bipolar Loop Resecting  0-Degree Vaporizing

Spring  Twizzle  Ball
Smith Nephew Morcellator

- Saline environment
- Resection of polyps
- Resections of fibroids
- No electrical energy used
- Uses its own fluid management system
- Must still follow fluid management guidelines
TRUCLEAR™ Hysteroscopic Morcellator

- Myoma Blade
- Polyp Blade
- Control Unit
- Continuous Flow Hysteroscope
### TRUCLEAR™ Morcellator Advantages

<table>
<thead>
<tr>
<th></th>
<th>TRUCLEAR™ Morcellator</th>
<th>Resectoscopy</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Speed</strong></td>
<td>• 10.6 min avg. OR time (blended)**</td>
<td>• 17.0 min avg. OR time (blended)**</td>
</tr>
<tr>
<td></td>
<td>• 8.7 min avg. OR time (polyps)*</td>
<td>• 30.9 min avg. OR time (polyps)*</td>
</tr>
<tr>
<td></td>
<td>• 16.4 min avg. OR time (fibroids)*</td>
<td>• 42.2 min avg. OR time (fibroids)*</td>
</tr>
<tr>
<td><strong>Safety</strong></td>
<td>• Blunt tip reduces risk of perforation</td>
<td>• Cuts easily through any tissue</td>
</tr>
<tr>
<td></td>
<td>• Saline</td>
<td>• Electrolyte or non-electrolyte</td>
</tr>
<tr>
<td></td>
<td>• Mechanical energy</td>
<td>• Electric energy</td>
</tr>
<tr>
<td></td>
<td>• Continuous visualization</td>
<td>• Interrupted visualization</td>
</tr>
<tr>
<td><strong>Ease of Use</strong></td>
<td>• No tissue chips</td>
<td>• Chips floating in uterus</td>
</tr>
<tr>
<td></td>
<td>• One insertion</td>
<td>• Multiple insertions</td>
</tr>
<tr>
<td><strong>Peace of Mind</strong></td>
<td>• 100% capture of aspirated tissue</td>
<td>• Burned tissue cannot be captured</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Difficulty of obtaining tissue chip</td>
</tr>
</tbody>
</table>
Advantages: Speed and Fluid Management

Studies show a significant decrease in OR time versus resectoscopy. A prospective randomized controlled trial showed reduction in operating time of 6.4 min. The below retrospective study stratifies data by polyps and myomas.

The Intra Uterine Morcellator: A New Hysteroscopic Operating Technique*

<table>
<thead>
<tr>
<th></th>
<th>OR Time</th>
<th>Fluid Deficit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Polyps</td>
<td>30.9</td>
<td>648.6</td>
</tr>
<tr>
<td>Myomas</td>
<td>42.2</td>
<td>741.0</td>
</tr>
</tbody>
</table>

R = Resectoscope
T = TRUCLEAR™ Morcellator

Advantages: Ease of Use

Clinical research supports that there is a short, narrow learning curve with the TRUCLEAR™ Morcellator.

Initial use of the device results in significantly lower operating times and insertions compared with traditional resectoscopy.

Hysteroscopic Morcellator for Removal of Intrauterine Polyps and Myomas: A Randomized Controlled Pilot Study Among Residents in Training*

<table>
<thead>
<tr>
<th></th>
<th>TRUCLEAR™ Morcellator</th>
<th>Resectoscope</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total OR Time (Min)</td>
<td>17</td>
<td>10.6</td>
</tr>
<tr>
<td>Insertions (#)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Take Control by Trainer (#)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Richard Wolf Chip E Vac System Components

• Very similar to current resectoscope

• Bipolar device

• For each “strip” of myoma or polyp resected, it is suctioned into hysteroscope and does not remain floating in the field
Components of Richard Wolf Chip E-Vac System
MyoSure® Tissue Removal System
MyoSure® Features

• Fast cutting rate of 1.5 grams per minute
• Small 6.25 mm outer diameter hysteroscope
• Single foot pedal, single speed
• Simple user interface
• Cutting blade’s angle and grade of stainless steel has been tested to cut dense fibroids.
• Window opening is optimized for superior tissue contact and is effective in removing fundal fibroids.
MyoSure® Control Unit

- Includes: control unit, foot pedal, power cord, users manual, set-up guide
- Drives 6000 RPM’s
Clinical Data & Results

Resection Performance

<table>
<thead>
<tr>
<th>Dia (cm)</th>
<th>Vol (cm³)</th>
<th>Time (min)*</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0</td>
<td>0.52</td>
<td>0.3</td>
</tr>
<tr>
<td>1.5</td>
<td>1.77</td>
<td>1.2</td>
</tr>
<tr>
<td>2.0</td>
<td>4.19</td>
<td>2.8</td>
</tr>
<tr>
<td>2.5</td>
<td>8.18</td>
<td>5.5</td>
</tr>
<tr>
<td>3.0</td>
<td>14.14</td>
<td>9.4</td>
</tr>
<tr>
<td>3.5</td>
<td>22.45</td>
<td>15.0</td>
</tr>
<tr>
<td>4.0</td>
<td>33.51</td>
<td>22.3</td>
</tr>
<tr>
<td>4.5</td>
<td>47.71</td>
<td>31.8</td>
</tr>
<tr>
<td>5.0</td>
<td>65.45</td>
<td>43.6</td>
</tr>
</tbody>
</table>
## Clinical Results: Myosure

<table>
<thead>
<tr>
<th>Doctor</th>
<th>Polyp/Fibroid</th>
<th>Size</th>
<th>% Removed</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Greenberg</td>
<td>Fibroid (Type I)</td>
<td>2.6 cm</td>
<td>100%</td>
<td>2.5 minutes</td>
</tr>
<tr>
<td>Greenberg</td>
<td>Polyp</td>
<td>5 mm</td>
<td>100%</td>
<td>1.2 minutes</td>
</tr>
<tr>
<td>Greenberg</td>
<td>Fibroid (Type I)</td>
<td>2.7 cm</td>
<td>100%</td>
<td>13 minutes</td>
</tr>
<tr>
<td>Miller</td>
<td>Polyp</td>
<td>5 mm</td>
<td>100%</td>
<td>30 seconds</td>
</tr>
<tr>
<td>Petrozza</td>
<td>Fibroid (Type II)</td>
<td>3 cm</td>
<td>30%-50%</td>
<td>4 minutes</td>
</tr>
<tr>
<td>Lukes</td>
<td>3 Polyps</td>
<td>0.5 cm</td>
<td>100%</td>
<td>16 seconds</td>
</tr>
<tr>
<td>Lukes</td>
<td>6 Polyps</td>
<td>0.5-3 cm</td>
<td>100%</td>
<td>42 seconds</td>
</tr>
<tr>
<td>Lukes</td>
<td>Fibroid (Type 0)</td>
<td>3 cm</td>
<td>100%</td>
<td>4 minutes</td>
</tr>
<tr>
<td>Roy</td>
<td>Fibroid (Type I)</td>
<td>3.5 cm</td>
<td>100%</td>
<td>4.7 minutes</td>
</tr>
<tr>
<td>Roy</td>
<td>Fibroid</td>
<td>1.5 cm</td>
<td>100%</td>
<td>38 seconds</td>
</tr>
<tr>
<td>Roy</td>
<td>Polyp</td>
<td>1.5 cm</td>
<td>100%</td>
<td>38 seconds</td>
</tr>
<tr>
<td>Roy</td>
<td>Polyp</td>
<td>2 cm</td>
<td>100%</td>
<td>58 seconds</td>
</tr>
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</table>
No Energy So What About Bleeding with Morcellators?

• Typically the bleeding with hysteroscopic morcellation is similar or less

• Continuous flow during procedure keeps the image clear

• Post procedure contraction of the uterus stops most significant bleeding

• Intrauterine pressure of pump can be increased to help tamponade any oozing

Loop resection
Remember to Deflate the Uterus
Intra Operative Surgical Techniques for Polypectomy

• If blind procedure is performed, look with hysteroscope to determine that full resection is completed

• Resect to the endometrium

• Remove and send all portions of polyp for pathology

• Determine if other pathology is present

• Final inspection to determine that full resection occurred
  – Check the endocervix and endometrial canal...don’t miss co-existing lesions
Hysteroscopic Myomectomy Surgery: Outcome Measures

• Effect on menstruation
  – 80-90% note improved menorrhagia
  – recurrence in 20%
  – improved dysmenorrhea if cramping noted with days of heavy flow
MENSTRUAL FLOW BEFORE AND AFTER HYSTEROSCOPIC RESECTION OF MYOMAS

Indman PD. Obstet Gynecol 1993; 81(5):716-20
MEASURED MENSTRUAL BLOOD LOSS IN FOUR PATIENTS UNDERGOING HYSTEROSCOPIC MYOMECTOMY

MBL (ml)

Time (months)

Pre-op

3

6

## SUBMUCOUS MYOMAS

Spaarne Hospital, Haarlem, NL

### Results

<table>
<thead>
<tr>
<th></th>
<th>Free of repeat surgery</th>
<th>Free of hysterectomy</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>266 patients</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 yrs.</td>
<td>91%</td>
<td>95%</td>
</tr>
<tr>
<td>5 yrs.</td>
<td>80%</td>
<td>89%</td>
</tr>
<tr>
<td>8 yrs.</td>
<td>73%</td>
<td>89%</td>
</tr>
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including larger uterus and > 2 myomas

Kees Wamsteker, MD, PhD  2003 personal communication
### Hysteroscopic Myomectomy Outcomes: 10 yr data

<table>
<thead>
<tr>
<th>subgroup</th>
<th>n</th>
<th>at 2 years</th>
<th>at 5 years</th>
<th>at 10 years</th>
</tr>
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<tbody>
<tr>
<td>Ut. normal</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 myoma</td>
<td>138</td>
<td>96</td>
<td>91</td>
<td>85</td>
</tr>
<tr>
<td>2 myomas</td>
<td>27</td>
<td>96</td>
<td>89</td>
<td>78</td>
</tr>
<tr>
<td>≥3 myomas</td>
<td>16</td>
<td>94</td>
<td>69</td>
<td>62</td>
</tr>
<tr>
<td>Ut. enlarged</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 myoma</td>
<td>56</td>
<td>92</td>
<td>73</td>
<td>70</td>
</tr>
<tr>
<td>2 myomas</td>
<td>19</td>
<td>94</td>
<td>83</td>
<td>68</td>
</tr>
<tr>
<td>≥3 myomas</td>
<td>10</td>
<td>83</td>
<td>74</td>
<td>66</td>
</tr>
</tbody>
</table>

Personal communication: Emmanuel
Number, Type, Weight of Fibroids and Operative Complications

<table>
<thead>
<tr>
<th>Number of fibroids</th>
<th>Number</th>
<th>Operative complications</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>175 (74.5%)</td>
<td>2</td>
<td>1.4</td>
</tr>
<tr>
<td>2</td>
<td>41 (17.4%)</td>
<td>3</td>
<td>7.3</td>
</tr>
<tr>
<td>3 or more</td>
<td>19 (8%)</td>
<td>1</td>
<td>5.3</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Type of fibroids*</th>
<th>Number</th>
<th>Operative complications</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>26 (11%)</td>
<td>0</td>
<td>0.0</td>
</tr>
<tr>
<td>1</td>
<td>45 (19%)</td>
<td>2</td>
<td>4.4</td>
</tr>
<tr>
<td>2</td>
<td>164 (70%)</td>
<td>4</td>
<td>2.4</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Weight of fibroids (g)</th>
<th>Number</th>
<th>Operative complications</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;3</td>
<td>137 (58.3%)</td>
<td>2</td>
<td>1.5</td>
</tr>
<tr>
<td>3-10</td>
<td>81 (34.5%)</td>
<td>3</td>
<td>3.7</td>
</tr>
<tr>
<td>&gt;10</td>
<td>11 (4.7%)</td>
<td>1</td>
<td>9.1</td>
</tr>
<tr>
<td>&gt;15</td>
<td>6 (2.5%)</td>
<td>0</td>
<td>0.0</td>
</tr>
</tbody>
</table>

*The Classification is based on the fibroid with the deepest intramural extension.  n = 235
Percentage of Patients Treated with Hysteroscopic Myomectomy Stratified by Intramural Extension and Completeness of Removal

Van Dongen H, et al., Acta Obstet et Gynecologica, 2006;85: 11463-1467
Characteristics of Hysteroscopic Surgery of Incomplete Removal of Fibroids

<table>
<thead>
<tr>
<th>Characteristics of surgery</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean size (diameter) of fibroid in cm (SD)</td>
<td>3.6 (1.2)</td>
</tr>
<tr>
<td>Mean volume of fibroid in cm (SD)</td>
<td>35.5 (31.4)</td>
</tr>
<tr>
<td>Type of fibroid (%)</td>
<td></td>
</tr>
<tr>
<td>Type 0</td>
<td>4 (9.8)</td>
</tr>
<tr>
<td>Type 1</td>
<td>14 (34.1)</td>
</tr>
<tr>
<td>Type 2</td>
<td>23 (56.1)</td>
</tr>
<tr>
<td>Median percentage residue (range)</td>
<td>27.5 (10-60)</td>
</tr>
<tr>
<td>Median operating time in min (range)</td>
<td>45.0 (20-80)</td>
</tr>
<tr>
<td>Median fluid deficit in ml (range)</td>
<td>1600 (900-2500)</td>
</tr>
<tr>
<td>Sorbitol in ml (range)</td>
<td>1500 (900-2300)</td>
</tr>
<tr>
<td>Saline in ml (range)</td>
<td>2100 (1600-2500)</td>
</tr>
</tbody>
</table>

Van Dongen H, et al., Acta Obstet et Gynecologica, 2006;85: 11463-1467

SD, standard deviation
Results of Hysteroscopic Fibroid Resection

<table>
<thead>
<tr>
<th>Results</th>
<th>Number</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Success</td>
<td>186</td>
<td>94.4</td>
</tr>
<tr>
<td>Failure</td>
<td>11</td>
<td>5.6</td>
</tr>
<tr>
<td>Repeat myomectomy</td>
<td>4</td>
<td>2.0</td>
</tr>
<tr>
<td>Hysterectomy</td>
<td>4*</td>
<td>2.0</td>
</tr>
<tr>
<td>Recurrence of symptoms</td>
<td>4</td>
<td>2.0</td>
</tr>
</tbody>
</table>

Mean follow-up period = 3.3 years (40 months). *Hysterectomy performed for obstetrical reason was not considered as a failure. n = 235

Operative Hysteroscopic Myomectomy: Avoidance of Future Surgery

- Hart 4 yrs (n=194) 79%
- Derman 9 yr f/u (n=94) 84%
- Emanuel 10 yr f/u (282) 74%
### Hysteroscopic Myomectomy for Abnormal Uterine Bleeding

<table>
<thead>
<tr>
<th>Study</th>
<th>Cases, no.</th>
<th>Follow-up, %</th>
<th>Average Follow-up Time, months</th>
<th>Success (No Study Further surgery), %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Polena et al.</td>
<td>235</td>
<td>84</td>
<td>40</td>
<td>94.4</td>
</tr>
<tr>
<td>Wamsteker et al.</td>
<td>51</td>
<td>93.3</td>
<td>20</td>
<td>93.3</td>
</tr>
<tr>
<td>Emanuel et al.</td>
<td>285</td>
<td>94</td>
<td>46</td>
<td>85.5</td>
</tr>
<tr>
<td>Cravell et al.</td>
<td>196</td>
<td>86.2</td>
<td>73</td>
<td>82.2</td>
</tr>
<tr>
<td>Marziani et al.</td>
<td>84</td>
<td>97</td>
<td>36</td>
<td>80.9</td>
</tr>
<tr>
<td>Kuzel et al.</td>
<td>45</td>
<td>100</td>
<td>48</td>
<td>100</td>
</tr>
<tr>
<td>Hart et al.</td>
<td>194</td>
<td>100</td>
<td>27</td>
<td>79</td>
</tr>
<tr>
<td>Munoz et al.</td>
<td>120</td>
<td>100</td>
<td>36</td>
<td>88.5</td>
</tr>
<tr>
<td>Brooks et al.</td>
<td>90</td>
<td>100</td>
<td>6</td>
<td>91</td>
</tr>
<tr>
<td>Derman et al.</td>
<td>177</td>
<td>100</td>
<td>108</td>
<td>83.9</td>
</tr>
</tbody>
</table>
## Fertility Rates after Hysteroscopic Myomectomy

<table>
<thead>
<tr>
<th>Study</th>
<th>Patients, no.</th>
<th>Follow-up, Period, months</th>
<th>% Follow-up</th>
<th>% with Pregnancies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ubaldi et al.</td>
<td>134</td>
<td>NA</td>
<td>NA</td>
<td>58.9</td>
</tr>
<tr>
<td>Goldenberg et al.</td>
<td>15</td>
<td>12</td>
<td>100</td>
<td>47</td>
</tr>
<tr>
<td>Shokeir</td>
<td>29</td>
<td>24</td>
<td>100</td>
<td>72.4</td>
</tr>
<tr>
<td>Bernard et al.</td>
<td>31</td>
<td>24</td>
<td>100</td>
<td>35.5</td>
</tr>
<tr>
<td>Giatras et al.</td>
<td>41</td>
<td>24</td>
<td>100</td>
<td>60.9</td>
</tr>
</tbody>
</table>
Hysteroscopic Myomectomy - Effective in Office Setting

Hysteroscopic removal of small endometrial polyps, and submucosal fibroids in an office setting

— Bettochi et al, 2009
— Bettochi et al, 2005
— Bettochi et al, 2002
— Lindheim et al, 2000
— Sesti et al, 2000

Hysteroscopic removal of small endometrial polyps, and submucosal fibroids (< 3.0 cm) in an office setting

— Comparative Office Sedation Study- No Adverse Events*
Individual Pictorial Blood Assessment Chart (PBAC) Scores before Hysteroscopic Polyp Removal and after 3 & 6 Months of Surgery

Informed Consent

- Fluid Overload
- Thermal injury
- Infertility
- Adhesions
- Bleeding
- Infection
- Uterine perforation

- Symptomatic hyponatremia
- Early termination
- Incomplete resection
- Hematometria
- Conversion:
  - Laparoscopy
  - Laparotomy
- Hysterectomy
- Death
Complications of Operative Hysteroscopy

• Jansen et al.
  – Tabulation of complications from 82 hospitals, 1997
  – 100% response rate
  – 13,600 procedures
    – Diagnostic and operative
    – Adhesiolysis (4.5%)
    – Endometrial resection (0.8%)
    – Myomectomy (0.75%)
    – Polypectomy (0.35%)

• 38/13,600 procedures
  – 0.28%

• Diagnostic procedures had lower complications than operative procedures
  – (0.13% vs 0.95%)

• Fluid overload 0.20%

• Uterine perforation 0.76%
  – 18/33 with cervical dilation
  – 0.16% had bleeding with perforation

Jansen FW. Obstet Gynecol 2000;96:266-270
Fluid Guidelines

• If using Glycine or Sorbitol solutions
  – Halt procedure when deficit is 1000 mL and order stat sodium and potassium level.
    – If normal proceed and completely stop procedure with total deficit of 1500 mL, recheck electrolytes and consider empiric diuresis with Lasix 20 mg IV
    – Monitor clinical symptoms if Na < 132

• If Normal Saline is used, more latitude
  – Halt procedure when deficit is 2,500 -3000 mL
  – Diuresis with Lasix, assess for pulmonary edema
Hyponatremia Mortality

• Mortality is dependent on severity

• Mortality rate of individuals with serum sodium < 130 mEq/L is between 40% and 50% in acute hospital cases\(^1\)

• Surgical patients with hyponatremia
  – Fatality rate of 11% compared to 0.2% of patients without hyponatremia\(^2\)

• Misdiagnosis
  – Leads to many cases of hyponatremia-induced fatalities\(^3\)

\(^1\)Martin RJ. *J Neurol Neurosurg Psychiatry*. 2004;75(suppl III):iii22-8.
Effects of Hyponatremia on the Brain

Normal brain (normal osmolality) → Immediate effect of hypotonic state → Water gain (low osmolality)

Osmotic demyelination → Improper therapy (rapid correction) → Loss of organic osmolytes (low osmolality) → Slow adaptation → Loss of sodium, potassium, and chloride (low osmolality)

Proper therapy (slow correction) → Rapid adaptation → Water

Diagnosis

• Signs and symptoms
• Patient history
• Physical assessment
Signs and Symptoms

- Headache
- Confusion
- Lethargy
- Fatigue
- Appetite loss
- Nausea and vomiting
- Loss of consciousness
- Restlessness
- Irritability
- Seizures
- Muscle weakness, cramps, spasms
Avoiding Complications of Hysteroscopy

• Careful history and physical examination
• Pre operative assessment of intracavitary abnormalities with
  – office hysteroscopy
  – saline infusion sonography (SIS)
• Advance hysteroscope in a clear view
• Strict adherence to fluid deficits
• Stop and reschedule surgery if fluid deficit is reached or if full resection can not be completed
Mechanisms of Fluid Absorption

- Intravascular
- Trans tubal
- Peritoneal
- Surgery is associated with increased endogenous arginine vasopressin causing retention of water
6 Factors Which Increase Risk of Fluid Overload

- Cervical lacerations
- Intrauterine pressure
- Degree of damage to endometrium
- Preparation of the endometrium
- Depth of myometrial resection
- Open vascular sinuses with deep myometrial resection
What To Do If You Perforate?

• Blunt dilator versus electrosurgical energy

• Determine if intra-peritoneal bleeding

• If electrosurgical device used, determine if bowel or visceral injury
  – Laparoscopy vs laparotomy
  – Need to have expert ability to evaluate the bowel
    – General surgery or colorectal surgery intra-operative consult

• Inform the patient and family

• Frequent post operative assessment essential
Avoiding Complications

- Do not exceed recommended infusion pressures
- Monitor input/output frequently
- Recognize signs & symptoms of fluid overload and hyponatremia
Reducing Risks

• Preoperative mapping
• Endometrial preparation
• Volume reduction
• Extra caution near cervix, cornua, and fundus
• Activate electrode under clear visualization
• Strict monitoring of fluid deficit
• Set deficit limit and adhere to it!!
Don’t Play Peek a boo or Telephone Medicine

• See and examine the patient
• Order appropriate laboratory and imaging tests
• Don’t hope the problem away
• Re-assess until the problem has resolved
Reimbursement

<table>
<thead>
<tr>
<th>CPT® AND HCPCS® CODE</th>
<th>DESCRIPTION</th>
<th>LOCATION</th>
<th>RVU</th>
<th>2011 NATIONAL AVERAGE MEDICARE RATE</th>
</tr>
</thead>
<tbody>
<tr>
<td>58555</td>
<td>Hysteroscopy, diagnostic (separate procedure)</td>
<td>Office</td>
<td>7.99</td>
<td>$271.47</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Hospital/ASC</td>
<td>5.65</td>
<td>$191.97</td>
</tr>
<tr>
<td>58558</td>
<td>Hysteroscopy, surgical; with sampling (biopsy) of endometrium and/or polypectomy, with or without D &amp; C</td>
<td>Office</td>
<td>10.60</td>
<td>$360.15</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Hospital/ASC</td>
<td>7.95</td>
<td>$270.11</td>
</tr>
<tr>
<td>58561</td>
<td>Hysteroscopy, surgical; with removal of leiomyomata</td>
<td>Office</td>
<td>16.33</td>
<td>$554.83</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Hospital</td>
<td>16.33</td>
<td>$554.83</td>
</tr>
</tbody>
</table>

2 Physician relative value units are based on a correction notice to the 2011 Physician Fee Schedule Final Rule published in the Federal Register on December 30, 2010. The National Average Medicare Rates are based on the 2011 conversion factor of $33,9764. Actual payment to a physician will vary based on geographic location. Payment for a given procedure in a given locality is available in the Medicare Physician look up file posted in the Physician Center of the CMS website. The payment rates could be further revised if Congress were to enact legislation that would change the conversion factor which has typically occurred in recent years.

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Discharge instructions

- Expect serious discharge 1-2 weeks
- Bloody discharge 7-21 days
- Cramping 24-48 hours
- No intercourse for one week
- Call if persistent pain or fever
Outcome of Case Study

• Pt underwent a operative hysteroscopic myomectomy
  ‒ Same day surgery
  ‒ 45 minute procedure
  ‒ 40 grams myoma resected
  ‒ No fluid overload
  ‒ Discharged home
  ‒ Back to work in 2 days

• Normal menstrual cycles and resolution of dysmenorrhea
Summary

• Excellent pre-operative evaluation is essential to determine, size, number and location of fibroids

• Excellent hysteroscopic skills with attention to fluid management is necessary

• Superb clinical outcome and minimal complications noted with operative hysteroscopy in appropriately selected patients