

# Operative Hysteroscopy

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Hysteroscope is used to view the uterine cavity and treat uterine conditions with minimal invasive techniques. With the advances in technology many procedures can be performed as an outpatient.

Hysteroscopy uses:

- Diagnostic
  - AUB
  - Infertility
  - Recurrent miscarriage
  - Confirm US findings
- Therapeutic
  - Ablation AUB
  - Infertility
  - sterilization
  - Fibroids
  - Polyps

Contraindications

- Active infection
- Pregnancy
- Cervical / endometrial cancer
- Medical co morbidities

## Instrumentation

### Scopes

Rigid

Flexible

### Sheath

Outer diameter tube house scope varies between 3.1-10mm

### Working elements

- Monopolar rollerball / barrel / vaportrode / needle
- Bipolar
- Mechanical eg myosure

### Distension media

- Low viscosity
- High viscosity
- Gas

### Light source

### Camera systems

The surgeon must understand every aspect of their instrumentation and should not rely on any body else to put the instruments together.

# Hysteroscopes

## Rigid

### Diagnostic

single flow

- obsolete
- useful when CO<sub>2</sub> is the distension media
- 5mm sheath with 4mm scope

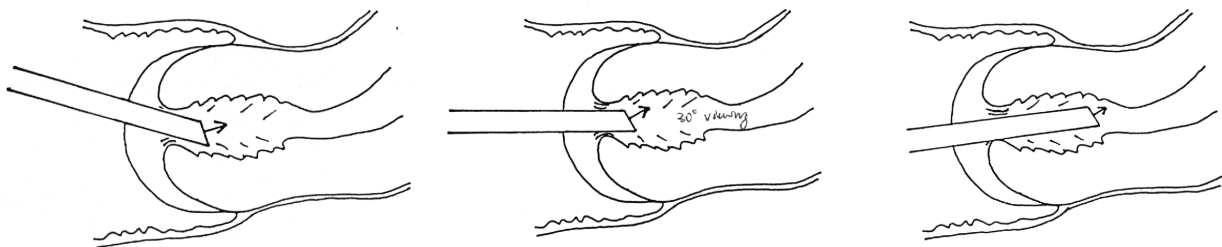
continuous flow:

have separate inflow and outflow channels therefore the major advantage is its usefulness when there is bleeding.

5.5mm with 3-5 Fr channel operative channel

Remember with 30° foreoblique scope:

- 1) when entering the uterus through the cervix the direction of insertion of the scope is NOT the centre of the camera view.
- 2) rotate the scope without moving the tip to view the ostia



## Operative hysteroscopes

(all use continuous flow)

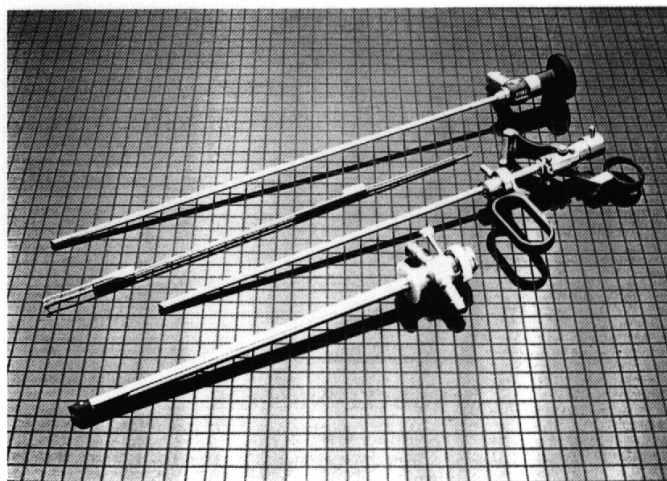
### Conventional

With 5fr working channel for flexible instruments

eg. Olympus 5.5mm sheath with 5 Fr channel for scissors + biopsy forceps

### Resectoscope

which consists of of 3 parts:



**Scope**

which is 3mm / 4mm

0°, 12°, 30°

Working distance 30-35mm.

**Working bridge with electrosurgical wire** ( resectoscope working element )

Loop / needle / roller ball / barrel

Return mechanisms can be passive or active

we suggest always to use a passive return mechanism.

**Continuous flow sheath** (8-9mm):

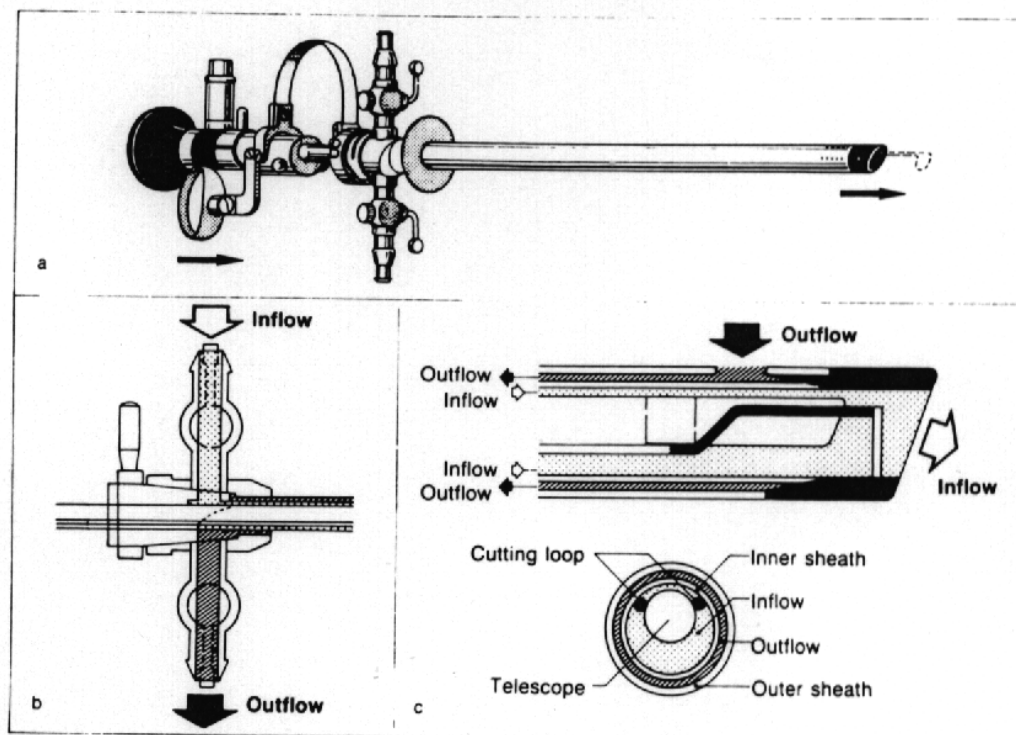
inner sheath for inflow

outer sheath for outflow

Sheaths can be rotatable or non rotatable

Locking mechanism for resectoscope can be rotary lock (Storz) or snap in lock (Olympus)

electrosurgery can be monopolar or bipolar

**Rigid mechanical scissors with scope inserted**

used for incision septum

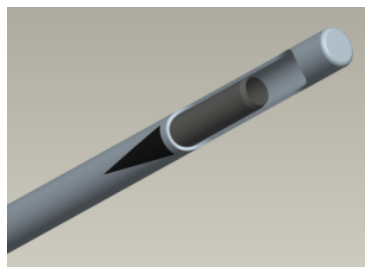
## Myosure

Introduced in 2009

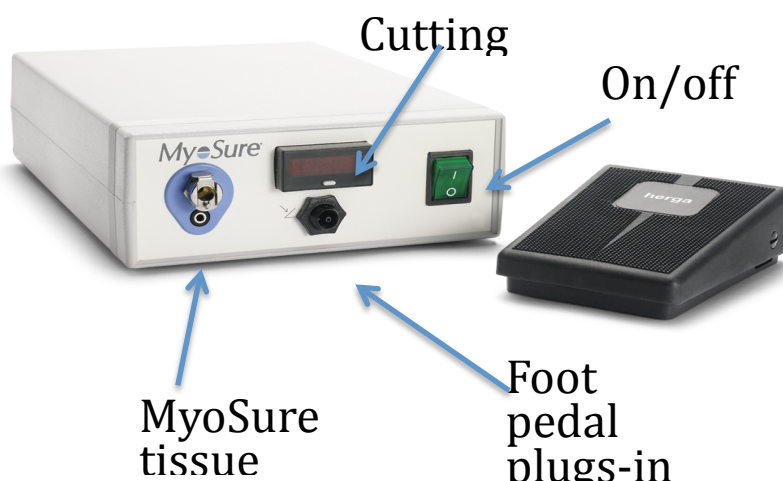
mechanical morcellator (6000rpm) incorporated into operative hysteroscope with fluid balance system to remove fibroids and polyps.

Cutting time of up to 1.5g/minute equates to removing 3cm myoma <10 minutes. Uses 0 degree scope

- no electrical energy ( bleeding may be more difficult to control)
- isotonic fluid
- incorporated with fluid / pressure control system (aqualux) with automatic measurement of fluid deficit
- tissue sucked and removed during the procedure for pathology, providing clear operative view
- device is recessed minimizing cutting into the myometrium ( fundal type 1 fibroids more difficult)
- small operating profile advantage for office setting



Cutting window



## Flexible Hysteroscopes

0° lens

Have fibreoptic image transmission enabling smaller diameter for the complete instrument.

Diameter range 3.5-5mm ( Olympus: 4.9mm with 2.2mm operative sheath ).

Single Flow

Uses:

Diagnostic. image less resolution and honeycomb effect

Operative. Can be used with semi-rigid instruments / laser

Main advantage is that for diagnostic purposes the smaller diameter means most patients do NOT require anaesthesia, however the flexible scope maybe difficult to use in a stenotic cervix as the scope is too soft. Suggested there is decreased trauma to isthmus (narrowest portion of uterus)

## Contact Hysteroscope

- Can only be used for diagnostic purposes.
- Do NOT require any distending media.
- Lacks panoramic view (field of view 6-8mm).

## Complications of hysteroscopy

- Diagnostic 1/1000
- Operative 1/100

complication	Diagnostic n= 11085	Operative n= 2515
total	0.13	0.95
perforation	0.13	0.75
Fluid overload	0	0.2

Procedure	Complication rate
Uterine adhesions	4.5%
TCRE / EA	0.8%
Myoma resection	0.8%
Polypectomy	0.4%

N= 13,600 from Jansen et al O&G 2000

## Complication

Perforation

Cause:

- Dilation / sounding
- Blind Hysteroscope insertion
- Operative procedure hot or cold

Bleeding

Cause:

- Perforation
- Operative site
- Cervical laceration

Infection <1%

Fluid overload

Embolism

Damage adjacent viscus

Thermal / electrical injury

## **Considerations for operative hysteroscopy / EA**

### **Preparation endometrium**

Ablation ideally performed in proliferative phase

GnRHa minimum 2 months shown improved amenorrhoea rates + less operating time + less fluid absorption + reduced morbidity with hypotonic fluid absorption

Danazol 2-4 weeks may be equivalent to GnRHa in 1 study metroplasty

OCP + MPA gestrinone have been used

### **Cervical preparation**

Misoprostol 200-400mcg PV

In premenopausal women systematic review concluded

- Reduced need further dilation RR 0.61
- Reduced risk cervical laceration RR 0.2
- Increased PV bleeding RR 11.09
- Increased cramping RR 8
- Increased fever RR 5.24

PM women

Inconclusive misoprostol as useful cf premenopausal women

estrogen 25mcg 2 weeks + misoprostol 1000mcg night preop resulted in increased mean cervical dilatation from 4.7mm – 5.7mm

Laminaria (osmotic dilators) may be used

### **Prophylactic antibiotics**

No RCT use AB with intrauterine surgery

Risk of clinical infection after REA low

Prudent to give AB in NREA as the necrotic debris is not completely removed

### **Vasopressin**

Injected intracervically :

- Reduced blood loss
- Reduced absorption distension fluid
- Facilitates dilation cervix

## **Distension media and devices**

Severe morbidity and mortality associated with absorption distension media, therefore a thorough understanding is important.

As little as 500ml hypotonic fluid absorption can lead to cerebral oedema, but most healthy patients can tolerate at least 1000ml.

Incidence in operative hysteroscopy of fluid overload 1/500-1/1000

Mechanisms:

- Hypo osmolality effects leading to cerebral oedema
- Fluid overload

### **Low Viscosity Fluid**

#### **Non electrolyte**

for use with monopolar RF energy ( adapted from TURP)

#### **Glycine 1.5%**

Non conductive amino acid

T  $\frac{1}{2}$  =90 minutes

Breakdown into H<sub>2</sub>O and ammonia (toxic & because of this isotonic 2.2% reduced to 1.5% hypotonic solution )

#### **Mannitol 5%**

Isotonic & diuretic, therefore safer non electrolytic solution

#### **Electrolytic**

Ideal to use

Normal saline

Most commonly used bipolar or mechanical hysteroscopy

Hartmans theoretical more physiologic, but not used

#### **Gas**

##### **CO<sub>2</sub>**

- used only for diagnostic purposes as blood & debris obscure view in operative hysteroscopy
- need low pressure / flow device avoid CO<sub>2</sub> embolus ( DO NOT use laparoscopic insufflator)

Hysteroflator for the delivery of CO<sub>2</sub>

- Flow limited 100mL/min.
- Distension pressure 50-70mmHg (max. 100mmHg).

NB: Cannot use laparoflator, which delivers gas in litres per minute for hysteroscopy.

- more pain + longer operating times cf NS in studies

### **High viscosity fluid**

Dextran 70 (hyskon)

- immiscible with blood
- 100ml absorbed expand to plasma volume to 900ml, therefore need to watch carefully fluid overload
- anaphylaxis incidence 1/800
- caramelizes quickly on instruments

## Devices

Mechanical systems that regulate flow /pressure and measure deficits eg Aquilex

- Records pressure in tubing  $\neq$  intrauterine pressure.
- Important to keep pressure maximum  $< 150\text{mmHg}$  (MAP) and ideally between 60-80mmHg to avoid intravasation of fluid.
- Flow rate is variable to maintain constant pressure (varies 50-200 ml/min).
- devices keep a record of fluid deficit but often overestimates deficit

## Gravity System

- Suspend 1m above patient.
- Need to use **wide bore** urology tubing (normal IV tubing does NOT allow satisfactory distension media flow rates).

## Factors related to fluid absorption and consequences:

Mechanism of absorption is from open deep venous sinus from transection and the rate and amount is dependent on Pressure of the infused fluid and Time :

- Type of surgery  
TCRM esp deep fibroids
- Media used  
Isotonic electrolytic safer
- Experience surgeon

## Methods to reduce fluid absorption

### GnRHa

Preop can reduce fluid absorption + reduce the severity of cerebral oedema by reducing estrogen mediated sex steroid sensitivity of the brain

Comparative studies on systemic absorption (fluid deficit) and GnRH agonist

Source	Year	Type of study	Procedure	No. of patients	Median or mean fluid deficit (mL)		p Value
					GnRH agonist	Control	
Taskin et al [48]	1996	RCT	Endometrial ablation	13	490 $\pm$ 82*	660 $\pm$ 48*	$<.05$
Donnez et al [49]	1997	RCT	Endometrial ablation	346	150	225	.03 <sup>†</sup>
Taskin et al [26]	1998	RCT	Endometrial ablation	17	540 $\pm$ 60*	760 $\pm$ 60*	$<.05$
Muzii et al [50]	2010	RCT	Myomectomy	39	378 $\pm$ 137*	566 $\pm$ 199*	$<.005$
Mavrellos et al [51]	2010	RCT	Myomectomy	47	300 (range, 0–1300)	500 (range, 0–975)	.84

GnRH = gonadotropin-releasing hormone; RCT = randomized controlled trial.

\* Mean  $\pm$  SD.

<sup>†</sup> Because of marked differences in reported mean values between centers, it was necessary to adjust for the effect of the centers. It was determined after adjustment that goserelin-treated patients absorbed on average a median of 40 mL less fluid than placebo-treated patients.

from JMIG 2013

## Vasopressin

Intraop can reduce intravasation ( $>500\text{ml}$ ) rr 0.15

## Endometrial ablation

Aim is to destroy endometrium to the basalis 4-6mm depth

Minimal invasive technique to treat AUB-O (ideally)

Goal hypomenorrhoea rather than amenorrhoea

Studies important look at patient satisfaction rates + reoperation rates rather than amenorrhoea rates.

Also the longer the studies likely higher failure rates

### Contraindications

Pregnancy

Endometrial cancer or hyperplasia

Patient at risk EH or cancer ideally should not have EA because delay diagnosis cancer, but safety of EA in these patients have not been well studied.

Desire to preserve fertility

Uterine anomalies

Thin myometrium eg myomectomy or caesarean section

Minimum thickness for EA not documented

For MEA min thickness 10mm

Caesarean section NOT CI to NREA

If thin myometrium, REA preferable and avoid thin part

### Special considerations

fibroids

enlarged uterus >12 weeks

adenomyosis

Parity  $\geq 5$  increased risk repeat surgery

## Additional procedures

### Myomectomy

Those with type 0 / 1 and selected type 2 fibroids may perform TCRM with EA, although the outcome of TCRM alone is not well established:

- combined procedure may have greater reduction MBL of TCRM alone, but
- no evidence difference in hysterectomy rates

REA preferred over NREA

Myoma characteristics for TCRM

- depth penetration
  - type 0 >95% complete fibroid removal
  - type 1 90% complete removal
  - type 2 70% complete removal..(in skilled hands)
- size
  - $\leq 3$  cm 10% required further surgery up to 4 years
  - $\geq 4$  cm 60%
- presence of other fibroids / adenomyosis influence success rates

in difficult cases consider:

- US guidance intraoperatively
- 2 stage procedure

techniques for TCRM

- loop resection ( monopolar or bipolar)
- vaportrode
- myosure
- US guided forceps removal fibroid

## **Sterilization**

Need additional contraception after EA

Concomitant hysteroscopic sterilization is convenient

FDA recommends sterilization followed by EA after 3 months (after confirming blockage with HSG) but practically can be performed at the same time.

Essure performed first (clear visualization) followed by EA..

- novasure.
  - Theoretical risk of heat conduction, but tubal serosal temperature <40 degrees.
  - HSG successfully completed in 96%
- HTA / Thermablate / MEA with concomitant Essure have all been used.

## **Mirena insertion**

Combined EA + mirena attractive:

- Improved bleeding
- Reduced pain esp. adenomyosis
- Concern scar tissue resulting unable to remove mirena

Controlled study n= 95 TCRE + mirena vs TCRE alone at 12 months found:

- Improved amenorrhoea 100% vs 9%
- Resolution dysmenorrhoea 90% vs 20%
- Reduced need further sx 0% vs 20%

No studies on NREA

## **Complications <5%**

fluid overload

perforation

haemorrhage

infection

Post Ablation Sterilization Syndrome (PASS)

tubal ligation with EA resulting in haematometra cornua

present with unilateral or bilateral pain cyclic

US or MRI may be used but not reliable

up to 10% cases

treatment:

- hysterectomy (definitive)
- hysteroscopy lysis
- resection cornua

## Outcomes of NREA vs REA

Perioperative	NREA	REA
Equipment failure	9.1	1.6
Fluid overload	0	0.3
Perforation	1.2	3
Haemorrhage	0.3	3
Infection	1	1
Cervical laceration	0.2	2

Postop		
Haematometra	0.9	2.4
Amenorrhoea ( at 5 years)	50	50
Patient satisfaction rates (5 years)	93	87
Hysterectomy (at 5 years)	14	19
Additional surgery	21	25

Modified from Cochrane 2009

## Endometrial ablation (EA)

### Hysteroscopic ablation / resection (REA)

TCRE / EA / vaportrode Techniques / bipolar electrodes

Points

- more versatile
- requires more surgeon skill
- specific complications eg fluid overload
- 

Determinants of success:

- Age (EA more successful women >45 years with need for additional surgery in women < 45 doubled from 27% to 54% up to 8 years.)
- *Surgeon experience important with improved success rate and less complications cf NREA*
- Adenomyosis / large uterus (although success good in experienced hands)

success:

- Variable amenorrhoea rates with 90% less bleeding
- 90% patient satisfaction rates

EA less complications TCRE:

- bleeding x3 with TCRE
- uterine perforation x4 with TCRE

Technique of EA

- endometrial preparation ideal
- cervical priming
- IV antibiotics
- dessication coagulation current 50W
- cornua first then fundus then side walls then anterior wall with posterior wall last
- avoid cervical canal
- use US in difficult cases

## **Partial EA**

Technique ablation anterior or posterior wall only with the aim of hypomenorrhoea

- simpler
- less risk adhesions / haematometra

AM McLausland et al study N=50 PEA with min followup 36 months found:

- reduced bleeding
- reduced cramps esp if endometrial penetration >2.6mm
- 86% patient were fully or partially satisfied

role of PEA with mirena??

## **Non hysteroscopic (blind) ablation techniques (NREA)**

Points

- Less skill required
- Quicker
- Less complications
- Higher equipment failure
- Limited normal cavities

All NREA results in high patient satisfaction rates >80% with low complications

Choosing a method depends on:

- Surgeon preference
- Equipment availability
- Uterine characteristics
- Ease use in office setting
- Need endometrial preparation

## **Novasure**

Uses bipolar radiofrequency electrical energy delivered through mesh probe (7.2mm) to ablate tissue to resistance 50 ohms with depth ablation 5mm with vacuum suction.



### **Procedure:**

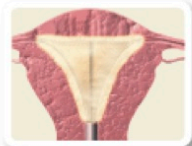
#### **Steps of the NovaSure Procedure:**



The NovaSure electrode array expands to conform to the contours of each patient's uterine cavity.



A unique proactive safety test called the Cavity Integrity Assessment is performed. The NovaSure system uses a small amount of CO<sub>2</sub> to verify cavity integrity prior to performing the procedure.



The NovaSure endometrial ablation procedure delivers radiofrequency energy until tissue impedance reaches 50 ohms; on average, the procedure is completed in approximately 90 seconds.<sup>3</sup>



The electrode array is retracted for easy removal, leaving the uterine lining desiccated down to the superficial myometrium.

- 50% amenorrhoea rates compare with 25% HTA. Other NREA NSD amenorrhoea rates
- >90% patient satisfaction rates
- hysterectomy rates 3-8%
- does not require endometrial preparation
- limited to uterine cavities >4 cm and >2.5cm width with fibroids <3cm

compared with REA

- NSD MBL or satisfaction rates
- Less OT time

### **Liquid filled Balloon ablation** ( thermachoice / cavaterm / thermablate)

- In general take slightly longer 8-10 minutes to perform
- 70-80% reported Reduced MBL

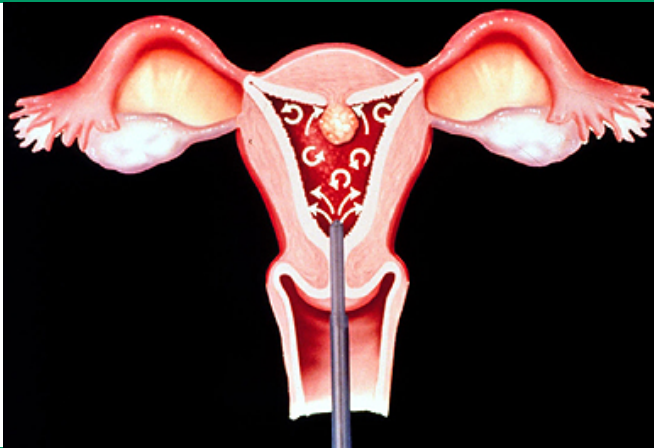
#### **Compared with REA**

- amenorrhoea rates higher with REA, but more complications
- 1 trial in SM fibroids type II , 3cm NSD vs REA

### **HTA**

Hysteroscopically directed circulation heated NS at 50-55mm Hg at 90 degrees 10 minutes then 45 degrees for 1 minute

#### **Circulating hot water system**



Hot water circulated throughout an abnormal cavity is able to make contact with all surfaces, potentially providing better endometrial ablation than with a nonconforming system, such as a balloon.

- cf REA NSD satisfaction rates (>98%) and reoperation rates (6-9%)
- cf Novasure lower amenorrhoea rates with higher x2 hysterectomy rate
- burns to vagina / perineum / leg from leaking fluid ( if more than 10mls lost equipment shut down
- Can treat abnormal cavities although higher rates of failure with SM fibroids

### **Cryoablation**

Probe inserted into the uterine cavity and cooled to <-20 degrees to form ice balls and observed under US to destroy the endometrium.

- Freezing causes numbness therefore less pain
- Requires US
- cf REA similar amenorrhoea, repeat ablation and hysterectomy rates

## MicroWave Endometrial ablation

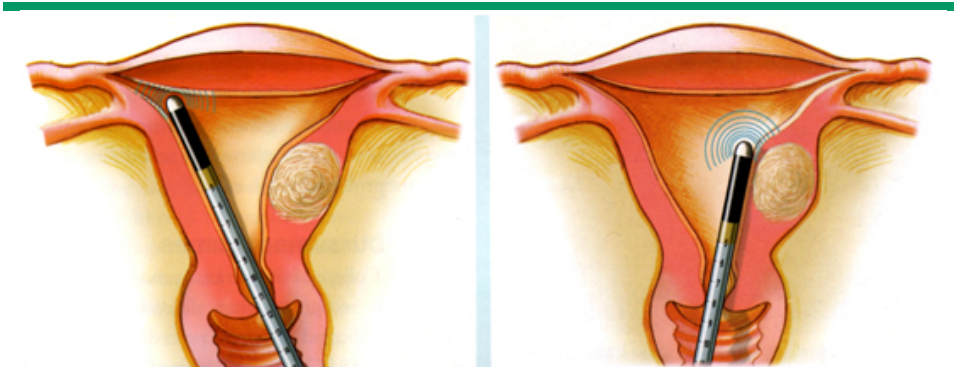
9.2GHz 8.5mm probe output 30W heat tissue 75-85 degrees to depth 6mm  
probe is moved from side to side from cornua



ME A Applicator

ME A System

## Microwave endometrial ablation



- More operator dependent cf other NREA, but then can treat fibroids up to 3cm + larger cavities up to 14cm
- Min thickness 1cm uterine walls as cases bowel burns with intact uterine wall

### ME A vs TCRE

- NSD amenorrhea rates at 1 year but higher satisfaction rates with ME A at 5 years (OR 2.3)
- Less risk haemorrhage (OR 0.14) but higher equipment failure (4.07)
- ME A lower hysterectomy rates at 10 years 17% vs 28%

## EA techniques compared

Cochrane 2009 21 studies with 3395 patients all with normal uterine cavity

First generation techniques compared:

- NSD MBL reduction and patient satisfaction
- Vaportrode (deeper coagulation) resulted easier operation, less fluid absorption and OT time cf TCRE
- EA OT time shorter cf resection

First generation vs second generation

- NSD MBL, amenorrhoea rates, patient satisfaction rates
- NREA less OT time, perforation (OR 0.32), fluid overload (OR 0.17), cervical laceration (0.22) and haematometra (0.31)
- NREA had higher equipment failure

NREA compared

Bipolar (Novasure) vs Balloon (thermchoice / cavaterm)

- Greater amenorrhoea rates
- NSD patient satisfaction

## Surgical therapies compared

EA vs hysterectomy

- Less operating time / quicker recovery / less complications but some unique risks with hysteroscopic ablation eg perforation, fluid overload etc.
- Lower proportion of women with improved MBL 85% vs 100% at 12 months
- NSD patient satisfaction rates at 4 years
- 3% required further intervention at 1 year, 20% at 2 years, 28% at 3 years and 38% at 4 years

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