Hysteroscopic Endometrial Ablation Is an Effective Alternative to Hysterectomy in Women with Menorrhagia and Large Uteri

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Abstract

Study Objectives. *To examine the feasibility, safety, and outcome of hysteroscopic endometrial ablation, and to determine the volume of fluid absorbed during resection versus rollerball coagulation in women with menorrhagia and large uteri.*
Design. *Retrospective review (Canadian Task Force classification II-2).*
Setting. *University-affiliated teaching hospital.*
Patients. *Forty-two consecutive patients (mean ± SD age 45.6 ± 6 yrs) with uterine size greater than 12 weeks (cavity >12 cm).*
Intervention. *Endometrial ablation; 26 (62%) women were pretreated to thin the endometrium.*
Measurements and Main Results. *Resection was performed in 27 patients (65%) and rollerball coagulation in 15 (35%). Ablation was successfully performed in all patients in a day surgery setting. Multiple regression analysis examined the relationship of uterine size, pretreatment, procedure, and duration of surgery to amount of glycine absorbed. Glycine absorption was higher with resection than with coagulation ($p = 0.04$). Fluid absorption correlated with type of procedure ($r = 0.32$, $p = 0.04$) but not with duration of the procedure, uterine size, or pretreatment. One patient with uterine fibroids and one with endometrial adenocarcinoma had hysterectomy. With follow-up of 39 (95%) of 41 women (excluding the one with adenocarcinoma) for 14 ± 2 months, 38 (93%) were very satisfied. Thirty (73%) had amenorrhea, six (15%) had hypomenorrhea (<3 pads/day), and three (7%) had eumenorrhea (<10 pads/day).*
Conclusion. *Hysteroscopic endometrial ablation may be a feasible, safe, and effective alternative to hysterectomy in women with menorrhagia and large uteri.*

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Hysteroscopic endometrial ablation was introduced in the 1980s as an alternative to hysterectomy in women with abnormal uterine bleeding of benign causes.[1–3] Its feasibility, safety, and efficacy were further validated in the 1990s using a variety of techniques and energy sources.[4–9] Although the procedure is cost effective compared with hysterectomy,[10–13] it is accompanied by the emergence of related complications such as uterine perforation,[9] cervical tears,[9] electrical injuries,[14–18] and excessive fluid absorption.[19–27]

Surgery with monopolar high-frequency electrosurgical generators to coagulate or resect the endometrium requires electrolyte-free distending solutions such as sugars or amino acids. Excessive, rapid, and unpredictable absorption of such solutions is one of the most serious complications of hysteroscopic

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surgery, as it may lead to electrolyte changes, and pulmonary and brain edema that may result in coma and even death.[19–27]

The net fluid filtration coefficient from the uterine cavity into the vascular compartment is expressed in milliliters of fluid per minute, per mm Hg of pressure, per 100 g of tissue.[28] Since the rate of absorption is directly proportional to the size of the uterine cavity and the uterus itself, and the amount of absorbed fluid is directly proportional to the duration of the procedure, it is recommended that a uterine cavity sounded greater than 12 cm in length be a relative contraindication to endometrial ablation. A uterus larger than a 12-week pregnancy or a cavity more than 12 cm in length should be ablated only by surgeons with considerable experience.[8] The success rate is reported to be significantly reduced in uteri larger than 12 weeks.[29,30]

We examined the feasibility, safety, and clinical outcome of hysteroscopic endometrial ablation in women with menorrhagia and uterine cavity greater than 12 cm. Fluid absorption during endometrial resection versus coagulation was also evaluated in two groups of patients.

Materials and Methods

From January 1996 to June 1998, 42 women (mean age 45.6 yrs, range 28–59 yrs; Figure 1) with a uterus larger than 12 weeks (cavity >12 cm; mean 13.5 cm, range 12–16 cm) underwent endometrial ablation by one surgeon (GAV). Twenty-six patients (62%) received preoperative hormone treatment to thin the endometrium (Table 1). Resection was performed in 27 (64%) patients and rollerball coagulation in 15 (36%; Table 2). As a rule, resection was performed in women with intrauterine lesions and/or thick endometrium. All patients had preoperative and/or intraoperative histologic evaluation of endometrium to exclude malignancy. Serum hormone profiles were performed in selected patients.

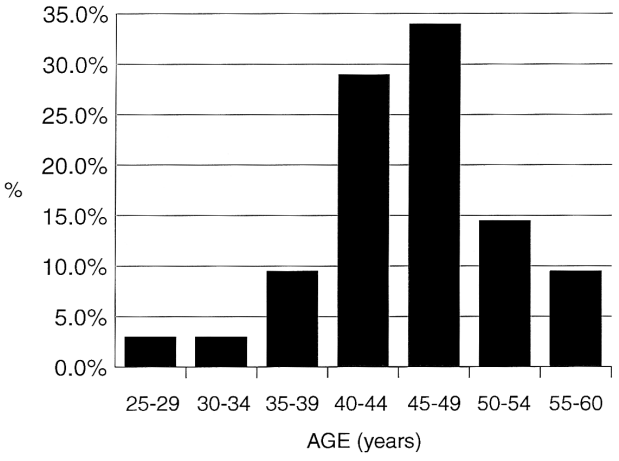

FIGURE 1. Age distribution of all patients.

Operative Procedure

Surgery was performed either under general anesthesia or with intravenous sedation with paracervical block. With the patient in dorsolithotomy position, the uterus was assessed by pelvic examination. Cervical dilatation was performed up to 10 mm and the uterine cavity was sounded and measured. A 9-mm (26F) resectoscope with a 30-degree telescope lens was used. A 2.5-mm rollerball was used for coagulation and an 8-mm cutting loop for resection. Diathermy power of 125 W for cutting and 100 W for coagulation was provided by a Force 2 generator (Valleylab, Boulder, CO).

The uterine cavity was distended with 1.5% glycine solution under gravity inflow of approximately 100 cm H_2O (75 mm Hg) pressure and suction outflow of 80 to 100 mm Hg. Inflow and outflow of the solution were frequently and closely monitored and recorded. The deficit was calculated by the volume of fluid before and after the procedure collected in 2-L graduated cylinders.

The uterine cavity was initially examined by videocamera. The uterine cornua and a narrow strip of the fundus were coagulated first with the rollerball in all patients. For women having rollerball ablation only, coagulation was started at the uterine posterior wall and sidewalls, followed by the anterior wall of the endometrium down to the level of the internal

TABLE 1. Preoperative Endometrial Thinning for Resection and Coagulation Groups

	Group	
Preoperative Therapy No. (%)	Resection, No. (%)	Coagulation, No. (%)
None 16 (38)	12 (44)	4 (27)
Zoladex 16 (38)	11 (41)	5 (33)
Oral contraceptive 6 (14)	3 (11)	3 (20)
Danazol 4 (10)	1 (4)	3 (20)
Totals	27 (64)	15 (36)

TABLE 2. Intraoperative Patient Variables and Results

	Resection	Coagulation	P
Mean ± SD age (yrs)	46 ± 5	45 ± 5	0.6
Mean ± SD procedure time (min)	31 ± 25	32 ± 22	0.4
Mean ± SD cavity length (cm)	13 ± 2	13.5 ± 2	—
Submucous myomectomy, no. (%)	7 (17)	0	0.06
Polypectomy, no. (%)	3 (7)	0	0.06
Mean ± SD glycine absorption (ml)	692 ± 200	481 ± 150	0.04

cervical os. For patients having loop resection, the entire endometrium and 2 to 3 mm of myometrium were resected as single long strips of tissue from the coagulated area at the fundus to the level of the internal cervical os. Frequently strips were removed from the endometrial cavity after each resection to enhance visualization and reduce the risk of incomplete resection of endometrium. Hemostasis was ensured by coagulating bleeding vessels with the loop electrode. All specimens were submitted for histopathology.

All patients were given postoperative analgesia as required. Forty women (95%) were discharged within 4 hours after ablation; two (5%) were hospitalized for observation because of underlying medical conditions or because of a long drive home. The patients were reviewed at intervals of 3, 6, 12, and 24 months postoperatively.

Statistical Analysis

Categoric data were summarized by proportions. Statistical significance of difference in proportions was based on Pearson's χ^2 test. Probability below 0.05 was considered statistically significant.

Follow-up

A questionnaire was developed to assess postoperative menstrual blood loss and overall patient satisfaction. Thirty-nine patients (93%) were followed; two could not be traced. Detailed clinical and operative records were reviewed and were correlated with the questionnaire.

Results

Endometrial ablation was successfully completed in all patients. Overall mean ± SD operating time was 29 minutes ± 25 (range 11–60 min) and overall mean ± SD amount of glycine absorbed was 645 ± 175 ml (range 50–2150 ml; Figure 2). Forty (95%) procedures were completed using fewer than two 3-L bags of glycine solution.

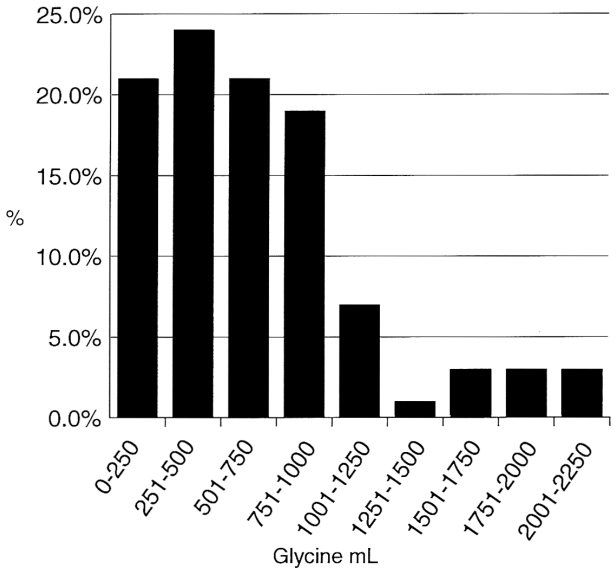

FIGURE 2. Glycine absorption in all patients.

The amount of glycine absorbed was higher during endometrial resection (692 ± 200 ml) than during rollerball coagulation (481 ± 150 ml, p = 0.041). Fluid absorption did not correlate with the duration of the procedure, uterine size, or preoperative endometrial thinning. Ten women (24%) required intravenous furosemide 20 to 40 mg because of a discrepancy between inflow and outflow of solution of more than 1500 ml.

Histopathologic findings are shown in Table 3.

At mean follow-up of 14 ± 2 months 30 (73%) of 41 patients reported amenorrhea, 6 (15%) had hypomenorrhea (<3 pads/day), and 3 (7%) had eumenorrhea (<10 pads/day; Table 4). Thirty-eight patients

TABLE 3. Histopathology of the Endometrium

Histopathology, No. (%)	Resection, No. (%)	Coagulation, No. (%)
Normal 28 (67)	13 (48)	15 (100)
Leiomyoma 7 (17)	7 (96)	0
Polyps 3 (7)	3 (11)	0
Simple hyperplasia 3 (7)	3 (11)	0
Adenocarcinoma 1 (2)	1 (4)	0
Totals	27 (100)	15 (100)

TABLE 4. Results for Patients after Follow-up of 14 ± 2 Months (mean ± SD)

	Group		
	Total (n=41)	Resection (n=27)	Coagulation (n=15)
No. (%) followed	39 (95)	25 (96)	14 (93)
Result, no. (%)			
Amenorrhea	30 (73)	20 (77)	10 (67)
Hypomenorrhea	6 (15)	4 (15)	2 (13)
Eumenorrhea	3 (7)	0	0
Menorrhagia	0	0	0
No. (%) very satisfied	38 (93)	24 (96)	14 (93)

(93%) were very satisfied with their treatment. One woman with fibroids and eumenorrhea requested hysterectomy.

A 46-year-old patient in whom endometrial adenocarcinoma was recognized intraoperatively underwent hysterectomy and bilateral salpingo-oophorectomy. A year earlier, endometrial biopsy showed simple endometrial hyperplasia, and she refused further evaluation and treatment. The uterus weighed 323 g and the cavity measured 12 cm, with a well-differentiated endometrial adenocarcinoma, grade I of III with mucinous differention, and invasion limited to the inner half of the myometrial wall. Adenomyosis and intramural myomas were also found. She was alive and well 5 years later with no adjunctive therapy.

Discussion

Menorrhagia (dysfunctional uterine bleeding, DUB) frequently exists in the absence of organic lesions of the endometrium. After medical therapy of at least 3 months' duration is ineffective, attempts at curative dilatation and curettage often fail and frequently are only temporizing.[31]

Hysterectomy, the traditional treatment for DUB, although curative, may be associated with up to 40% morbidity and mortality approaching 1/1000 procedures performed for nonobstetric and benign causes.[32–34] Consequently, other surgical alternatives have been introduced.

Hysteroscopic endometrial ablation to remove or destroy the endometrium reduces or eliminates menses. The success of the procedure is thought to be influenced by several factors, including the surgeon's experience, energy source, prethinning of endometrium, and size and length of the uterine cavity.[8,28,29] Long-term follow-up results indicate that the overall success rate is up to 90%.[35–37]

Histologically, the endometrium consists of a functional and a basal layer. The functional layer responds to hormonal stimuli and it changes in morphology and thickness throughout the menstrual cycle. This results in varying endometrial thickness from 3 to 12 mm. In a substantial minority of women, endometrial glands and stroma may extend from the basal layer into the myometrium for a variable distance. Whether this is a deviation from normal is unclear. Therefore, to achieve an effective result, we resected the endometrium to a depth such that no residual endometrial glands could be seen and coagulated until the entire endomyometrium attained a definite honeycomb appearance.

Hysteroscopic surgery requires continuous irrigation to maintain uterine distention and a clear visual field. Large amounts of irrigant fluids are often used. Fluid movement through tissue, including endomyometrium, into the intravascular compartment follows the well-known principle of physiology proposed by E. H. Starling at the beginning of this century.[38] Starling hypothesized that under normal conditions a state of near-equilibrium exists at the capillary membrane, whereby the amount of fluid filtering outward through arterial capillaries equals that quantity of fluid that is returned to the circulation by reabsorption at venous ends of capillaries. The five primary factors that determine fluid movement across capillary membranes are as follows:

1. Mean capillary pressure (range 15–25 mm Hg) is directly proportional to mean arterial pressure and tends to push fluid out of the vessel.

2. Interstitial fluid colloid osmotic pressure (range 4–6 mm Hg) tends to cause osmosis of fluid out of the vessel.

3. Plasma colloid osmotic pressure (range 24–32 mm Hg) tends to cause osmosis of fluid into the vessel.

4. Interstitial fluid pressure (turgor, range 5–7 mm Hg) tends to move fluid into the vessel.

5. Permeability of capillary membranes.

Disturbance of this equilibrium merely by distending the uterine cavity with fluid pressure results in net fluid movement into uterine interstitial tissue and capillary bed, and subsequently into the vascular compartment. To minimize the effect of this factor it is recommended that intrauterine pressure be maintained lower than the patient's mean arterial pressure.[39] This is accomplished by either a fluid infusion pump monitoring intrauterine pressure or gravity inflow at approximately 100 cm of water pressure (75 mm Hg). In addition, negative suction to the outflow tubing of 80 to 100 mm Hg will ensure low intrauterine pressure and rapid elimination of debris and gas bubbles generated during the procedure.

Unlike the bladder, which is more distendable, the uterus accommodates irrigating fluid with a rise in intrauterine pressure, which presumably leads to absorption of fluid either across the endometrial surface or through open blood vessels. The intraperitoneal route, either through fallopian tubes or by perforation, also may contribute to absorption during hysteroscopy.[38] Such absorption during any type of transcervical surgery may lead to fluid overload, metabolic disturbance, and even death.[19–27]

Pretreatment of patients with two subcutaneous injections of a gonadotropin-releasing hormone analog (goserelin) 3.6 mg 6 and 2 weeks before endometrial resection reduced glycine absorption by 33%.[40] In the present study fluid absorption did not correlate with preoperative endometrial thinning, most likely due to small numbers of patients in the various groups.

It is imperative that fluid absorption be monitored diligently throughout ablation procedures. Several commercially available systems take into account inflow and outflow weight of fluid as well as delivering the fluid at a predetermined pressure. We routinely use gravity inflow of 75 mm Hg and suction outflow of 80 to 100 mm Hg. The fluid is collected in 2-L calibrated cylinders, and volume is monitored by the surgeon and nursing staff. We have encountered no serious complications with excessive fluid absorption in over 2500 endometrial ablations.

In our study fluid absorption was higher during resection than during rollerball coagulation ($p = 0.041$), but correlation with duration of the procedure, uterine size, and hormone pretreatment was poor. A randomized study reported that endometrial ablation with the vaporizing electrode decreased mean fluid absorption from 367 to 109 ml (70% reduction) compared with resection with the standard cutting loop.[41] We also found decreased mean fluid absorption of 692 and 481 ml (30% reduction) in the resection and coagulation groups, respectively. This clearly indicates that the factor contributing most to rapid and excessive fluid absorption is cutting into vascular channels with the loop electrode during resection (increasing the permeability factor of the Starling equilibrium), allowing direct intravascular infusion of irrigant solution.

Comparing findings of the two studies, it is also clear that fluid absorbed by large uteri is considerably higher with both resection (367–692 ml, 47%) and coagulation (109–481 ml, 77%). This indicates that uterine size by itself may also be a major factor in fluid absorption as predicted by the Starling hypothesis. Because of the small number of patients in our groups, however, we were unable to show statistical significance.

Conclusion

On the basis of this study, we believe that hysteroscopic endometrial ablation may be a feasible, safe, effective alternative to hysterectomy in women with menorrhagia and large uteri. Fluid absorption appears to be greater with resection than with rollerball coagulation; however, with appropriate monitoring of the inflow and outflow and administration of furosemide when indicated, serious complications can be avoided.

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