

The effectiveness and cost-effectiveness of microwave and thermal balloon endometrial ablation for heavy menstrual bleeding: a systematic review and economic modelling

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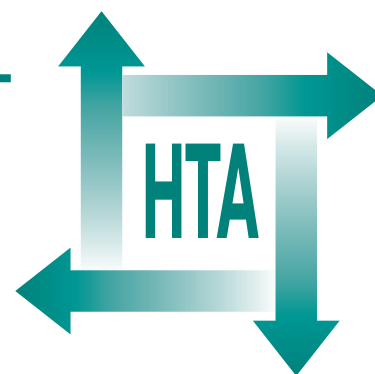
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Executive summary

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Executive summary

Objective

The aim of the project was to estimate the clinical effectiveness and cost-effectiveness of microwave endometrial ablation (MEA) and thermal balloon endometrial ablation (TBEA) for heavy menstrual bleeding (HMB) compared with the existing (first-generation) endometrial ablation (EA) techniques of transcervical resection (TCRE) and rollerball (RB) ablation, and hysterectomy.

Description of proposed service

The technologies examined in this review are MEA and TBEA for the treatment of HMB. Both of these, also referred to as second-generation EA techniques, aim to destroy the endometrial lining of the uterus, thereby reducing or eliminating menstrual bleeding. To achieve endometrial destruction, TBEA uses a balloon catheter in which hot water is circulated for a prescribed amount of time. MA uses microwaves of a wavelength that will be absorbed to a defined depth of tissue. Both treatments may be performed under local or general anaesthetic and are performed without direct visualisation of the uterus.

Epidemiology and background

HMB (or menorrhagia) is defined as the cyclical loss of more than 80 ml of blood over several consecutive cycles. HMB is a common complaint for which one in 20 women aged 30–49 years consult their general practitioner each year (approximately 1.5 million women in England and Wales). Quality of life may be impaired by such bleeding.

Current treatments for HMB include various drug regimens, such as tranexamic acid, mefenamic acid, the combined pill and the progestogen-releasing intrauterine system. Danazol, gestrinone and gonadotrophin-releasing hormone (GnRH) analogues may be used as second-line medical treatment. Current surgical interventions include hysterectomy or minimally invasive procedures such as TCRE and RB ablation.

Over 51,000 hysterectomies were performed in the public sector in England in 1999–2000. In about half of these cases, HMB would have been the presenting complaint, and in half of these, the uterus would have been normal. In 1998–9 more than 16,000 admissions for EA were recorded.

This report assesses the effectiveness and cost-effectiveness of MEA and TBEA compared with specific existing surgical techniques for HMB, that is, first-generation EA techniques [by resection (TCRE) and/or RB] and hysterectomy.

Number and quality of studies and direction of evidence

A detailed search strategy was carried out to identify systematic reviews and controlled trials of MEA and TBEA versus first-generation techniques for EA. In addition to electronic database searching, reference lists were hand-searched and information sought from manufacturers of EA devices and by experts in the field.

Two good-quality systematic reviews, of the effectiveness of hysterectomy versus first-generation ablation methods and endometrial destruction techniques for HMB (2002), were included.

Two randomised controlled trials (RCTs) of MEA and eight trials of TBEA versus first-generation techniques were included. These trials include a total of 1561 women, with sample sizes ranging from 20 to 322 (median 143). Two of the TBEA trials were non-RCTs and the rest were RCTs.

The quality of the trials was variable. The MEA trials included more participants than TBEA trials and were of higher quality and applicability to the UK. Two TBEA studies were not randomised; controls in one were women who underwent first-generation EA at the same institution, and in the other two consecutive cohorts were compared. Of the RCTs, seven used appropriate allocation to groups; one MEA study reported blind assessment of outcomes; one MEA and four

TBEA studies showed that the groups were comparable at baseline and six studies (one MEA and five TBEA) gave the same intervention and control treatment to all women. Both MEA studies used subcutaneous GnRH analogues as an endometrial pre-thinning agent in both intervention and control groups. Of the TBEA trials, two gave a dilation and curettage (D&C) immediately prior to the operation in both arms of the trial, two gave GnRH analogues to women in both arms of the trial and one gave no pretreatment to those undergoing TBEA, and GnRH to those in the control group. One gave D&C to women undergoing TBEA, and GnRH to women undergoing TCRE.

Only one MEA and three TBEA studies reported undertaking a sample size calculation. One of these (TBEA) did not recruit sufficient participants to meet requirements. Loss to follow-up was between 0 and 46% (median 3.5%) – the highest figure at 5 years of follow-up (TBEA versus RB). Of the six studies that reported some loss to follow-up, two reported using intention-to-treat (ITT) analysis, although one appears to have used different denominators for some variables. One study does not report loss to follow-up, but does not appear to have data on all recruited women. Based on the adequacy of the description of participant characteristics and inclusion criteria, the generalisability of the studies was judged by reviewers as high in one MEA and three TBEA cases, medium in three TBEA studies and low in one MEA and two TBEA studies. Main outcome measures were measured independently in eight cases and were uncertain in two TBEA studies.

Summary of benefits

The systematic review of first-generation EA techniques versus hysterectomy found that EA offered an alternative to hysterectomy for HMB, with fewer complications and a shorter recovery period. Satisfaction and effectiveness were high for both techniques. Costs were lower with EA although the difference narrows over time.

Owing to clinical heterogeneity between trials of first- and second-generation EA techniques, meta-analysis was not undertaken.

The included studies of MEA and TBEA did not show a significant difference between amenorrhoea rates after first-generation compared with second-generation techniques. Only one

study showed a first-generation technique (RB) to be significantly superior for the outcome of amenorrhoea measured at 2 years. The median proportion of women with the outcome of amenorrhoea is higher among those treated with MEA (46%) than those with TBEA (14%), although the ranges overlap (MEA 36–55%; TBEA 10–40%) and the amenorrhoea rates in the MEA trials were also higher for the control group. No comparison between MEA and TBEA should be inferred on the basis of amenorrhoea rates between second-generation techniques alone as there were similar differences between control groups across trials. No significant differences between first- and second-generation techniques of EA were shown for any other measure of bleeding.

No significant differences between the results of first- and second-generation EA were found for dysmenorrhoea or premenstrual symptoms.

Differences in patient satisfaction reported between first- and second-generation EA techniques were not significant. One study used the Short Form with 36 Items to measure quality of life (QoL) and found that six of the measures improved significantly after MEA, as did seven of the items for women in the TCRE/RB treatment group.

Compared with first-generation EA techniques, second-generation techniques resulted in significantly shorter operating and theatre times, but not in postoperative length of stay or recovery time.

Perioperative and postoperative adverse effects were few with both first- and second-generation techniques, but there were fewer serious perioperative adverse effects with MEA and none with TBEA compared with first-generation techniques. Postoperative adverse effect rates were similar.

Second-generation EA techniques are an alternative treatment to first-generation techniques for HMB. First-generation techniques are known to offer an alternative to hysterectomy. Although no trials of second-generation techniques and hysterectomy have been undertaken, it seems reasonable to assume that second-generation techniques also offer an alternative surgical treatment. No head-to-head trials of second-generation techniques have been undertaken and there is not enough evidence to identify differences between the clinical effectiveness of TBEA and MEA. ►

Costs

Costs of technologies were estimated for 2002. The costs of TBEA and MEA were similar at £1273 and £1295 per procedure, respectively. Methods used to calculate costs may not have been sufficiently sensitive to measure such small apparent differences with precision. The cost of second-generation ablation is slightly less than combined TCRE and RB ablation at £1614 but slightly more than RB at £1191. Abdominal hysterectomy costs £2275.

Cost-effectiveness

A deterministic Markov model was developed to assess cost-effectiveness. Data for the model were taken from a range of sources. For MEA compared with TBEA, costs were very slightly higher for MEA (£1448 versus £1324 per woman), and differences in quality-adjusted life-years (QALYs) were negligible (8360.70 versus 8360.77 for the whole cohort). For MEA compared with TCRE and RB ablation, costs were slightly lower with MEA (£1448 versus £1732 TCRE, £1752 RB and £1785 TCRE/RB combined) and MEA accrued very slightly more QALYs (8.361 versus 8.357 TCRE, 8.360 RB and 8.358 TCRE/RB). Compared with hysterectomy, MEA costs less (£1448 versus £2320) and accrues slightly fewer QALYs (8.361 versus 8.774).

For TBEA compared with TCRE and RB ablation, costs were lower with TBEA (£1324 versus £1732 TCRE, £1752 RB and £1785 TCRE/RB combined) and TBEA accrued slightly more QALYs (8.361 versus 8.357 TCRE, 8.360 RB and 8.358 TCRE/RB). Compared with hysterectomy, TBEA costs moderately less (£1324 versus £2320) and accrues moderately less QALYs (8.361 versus 8.774).

Sensitivity analyses

The economic model was found to be particularly sensitive to changes in the utility value for women who had recovered from having an EA, in other words, women who were 'well'. To a lesser extent, recurrence of HMB and the cost of the procedures were also important in the analysis.

Limitations of the calculations

Given the paucity of data about utility values for the health states relating to HMB, EA and post-

convalescence, accurate estimates of costs per QALY are difficult to ascertain. As absolute costs and QALYs for MEA and TBEA are very similar, small changes in inputs relating to aspects of the procedure that affect costs can lead to large changes in the model outputs. There must, therefore, be considerable uncertainty about the precision of these results. In particular, we are not confident that available data are significantly robust to support comparison between second-generation techniques.

Other important issues regarding implications

Longer term follow-up is required to collect further data on failure rates and subsequent re-treatment.

TBEA is not suitable for women with larger uterine cavities (>12 cm) and those with uterine pathology or abnormalities. This may account for as many as 60% of women with HMB, although estimates are uncertain.

Notes on the generalisability of the findings

Of the 10 included trials, five TBEA studies excluded women with fibroids and one TBEA study included only women with fibroids. This may not represent those women considered suitable for EA in routine practice and may influence effectiveness. In addition, only one study (of MEA) uses self-reported menorrhagia as an inclusion criteria, as would be usual in clinical practice. For the five studies (one of MEA and four of TBEA) using stringent measurements of HMB based on high pictorial blood loss assessment chart scores, higher rates of satisfaction may result as all have objectively measured menorrhagia initially. Such women have been shown to rate treatment as more satisfactory than women with less bleeding. Finally, one TBEA study includes some women who are post-menopausal but who did not wish to stop taking hormone treatment. The authors believe that this group is unlikely, currently, to be treated by EA in the UK.

Conclusions

Both MEA and TBEA techniques appear to offer effective alternatives in the surgical treatment of women with HMB. ►

Second-generation techniques are quicker to perform and appear to provide similar outcomes to first-generation approaches. First-generation techniques are associated with fewer adverse effects than hysterectomy and there is evidence in favour of greater safety for second- over first-generation techniques. In trials between first- and second-generation techniques, there were very few significant differences in the main clinical outcomes.

In essence, there seems to be little discernible difference between second-generation techniques on the basis of currently available data. However, TBEA may be suitable for fewer women as it has more restrictions on uterine size, abnormality and pathology. Both MEA and TBEA appear to offer similar outcomes to older ablation techniques at similar or lower costs. It is not possible to predict which patients will become amenorrhagic and the differences are small. If amenorrhoea is the preferred outcome, hysterectomy is the most effective technology, but with higher costs. The cost–utility ratio for hysterectomy versus EA is within the range considered by decision-makers to represent acceptable value for money.

Need for further research

- Head-to-head comparisons of second-generation EA techniques should be considered.
- Longer term follow-up for all methods of EA in RCTs will provide better information about failure rates and repeat procedures, in addition to checking whether longer term complications are an issue.
- More sophisticated modelling studies may improve estimates of cost-effectiveness, taking

into account population heterogeneity, and would permit exploration of issues relevant to implementation such as waiting times and detailed budget impact.

- Given the importance of the utility values in determining the cost-effectiveness of treatments for HMB, further research to establish utilities for the states of HMB, its surgical treatment, convalescence and complications of treatment would be valuable.
- Future studies of HMB should use validated QoL measures and established modes of measuring patient satisfaction both with the procedure and with the outcomes.
- Further research into the effect of the constellation of symptoms associated with menstruation (such as pain, bloating and breast tenderness) and the part that these symptoms play in women's perceptions of bleeding and the effect of its treatment could help to establish which women will find treatment of bleeding alone acceptable.
- Alternative models of care for EA should be further investigated, including different operators (non-consultant medical staff and specialist nurses) and different settings (office versus operating theatre).

Publication

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