TITLE: Electrosurgical Devices for Vessel Sealing: Clinical Effectiveness, Cost-Effectiveness, and Safety

DATE: 16 February 2010

RESEARCH QUESTIONS:

1. What is the clinical effectiveness of electrosurgical vessel sealing for the management of bleeding vessels in operating room settings?

2. What is the risk of thermal spread as a complication of use of reusable versus single-use vessel sealing devices and equipment?

3. What is the cost-effectiveness of electrosurgical devices for vessel sealing?

METHODS:

A limited literature search was conducted on key health technology assessment resources, including PubMed, the Cochrane Library (Issue 1, 2010), University of York Centre for Reviews and Dissemination (CRD) databases, ECRI, EuroScan, international health technology agencies, and a focused Internet search. The search was limited to English language articles published between 2005 and February 2010. Filters were applied to limit the retrieval to health technology assessments, systematic reviews, meta-analyses, randomized controlled trials, controlled clinical trials, observational studies, and economic studies. Internet links were provided, where available.

The summary of findings was prepared from the abstracts of the relevant information. Please note that data contained in abstracts may not always be an accurate reflection of the data contained within the full article.

RESULTS:

HTIS reports are organized so that the higher quality evidence is presented first. Therefore, health technology assessment reports (HTA), systematic reviews, and meta-analyses are
presented first. These are followed by randomized controlled trials (RCTs) and economic evaluations. Due to the availability of numerous RCTs, controlled clinical trials and observational studies were not included.

One health technology assessment report, four systematic reviews, 15 randomized controlled trials, and one economic study were identified. Additional information that may be of interest has been included in the appendix.

OVERALL SUMMARY OF FINDINGS:

Electrosurgical tonsillectomy

One HTA,1 and two RCTs15,16 pertaining to electrosurgical devices for tonsillectomy were identified. The HTA compared coablation with electrocautery for tonsillectomy in children and found electrocautery to be associated with less blood loss, lower operation time, and higher post-operative pain scores.1 There were no differences in complication rates, including hemorrhage, and there was more tissue damage associated with electrocautery than with coablation. Both RCTs examined tonsillectomy in adults.15,16 When electrosurgical vessel sealing (EVS) was compared to harmonic scalpel, it was associated with reduced bleeding and was similar with respect to operating time and post operative pain.15 When different tonsillectomy techniques were examined with respect to post operative pain, electrocautery was the most painful technique compared to fibrin sealant and CO2 laser.16

Electrosurgical hemorrhoidectomy

One systematic review2 and two RCTs14,19 pertained to hemorrhoidectomy. The systematic review2 and one RCT14 compared EVS to diathermy. While the RCT found EVS to be associated with lower mean operative time and lower intraoperative bleeding,14 the systematic review found these outcomes, as well as the length of hospital stay, to be similar in the EVS and diathermy groups.2 The systematic review also found that pain scores were lower in the EVS group and the authors deemed EVS to be superior to diathermy due to patient tolerance.2 When EVS was compared to stapling for hemorrhoidectomy, pain, patient satisfaction, and return to daily activity were found to be equal in the two groups.19

Electrosurgical hysterectomy

One systematic review5 and three RCTs7,11,18 were identified that examined electrosurgical techniques during vaginal5,7,18 or abdominal11 hysterectomy. EVS was found to reduce operating time,5,7,11,18 and lower post-operative pain5,11,18 in the majority of the studies. The two RCTs that reported complication rates found no difference between EVS and conventional clamp and suture techniques.7,11 The systematic review found EVS to be associated with a decreased length of hospital stay for patients undergoing vaginal hysterectomy5 and the RCT examining abdominal hysterectomy found that the length of hospital stay was not reduced by EVS.11 The systematic review5 and one RCT7 noted that vessel sealing equipment may be of extra benefit in cases where there is a high risk for complications.
Electrosurgical Devices for Vessel Sealing

Hip or knee arthroplasty

Three RCTs examined the use of vessel sealing and electrocautery in hip or knee arthroplasty. One RCT found no differences in blood loss between bipolar vessel sealing and electrocautery techniques and concluded that due to the high cost of the vessel sealing device, EVS is not recommended for total hip arthroplasty. Two RCTs found EVS to be associated with lower blood loss, fewer transfusions, less tissue damage, and less smoke production compared to standard electrocautery in knee and hip arthroplasty. This was found even in patients at higher risk for blood complications.

Other indications

One systematic review found suction electrocautery to be favourable with respect to intraoperative hemorrhage and operating time in pediatric adenoidectomy. In trials comparing EVS to standard clamping and surgical care, EVS was found to reduce operative time for laparoscopic appendectomy and major and minor liver surgery. When compared to the harmonic scalpel for thyroid surgery, the harmonic scalpel resulted in shorter operative time but otherwise there were no differences in outcomes compared to EVS. With respect to reducing blood loss, EVS was more effective than clamping in liver surgery, was more effective than monopolar scissors in laparoscopic colorectal surgery, and was no different than endodissection and clips for appendectomy. Also with respect to blood loss, the harmonic scalpel was associated with lower blood loss and less need for transfusion than standard electrocautery for posterior instrumentation of the spine and EVS was associated with higher blood loss than staplers and disposable clip appliers in colectomy.

One systematic review considered multiple indications. Compared to clamping with suture ligation combined with electrocauterization, electrothermal bipolar vessel sealing (EBVS) resulted in reduced operative times, reduced blood loss, fewer complications, and a reduction in post-operative pain in procedures such as hysterectomy, thyroidectomy, and hemorrhoidectomy.

Cost information

Four of the identified studies contained cost information. The identified economic study compared the harmonic scalpel with electrocautery for posterior instrumentation of the spine and found it to be cost neutral. The HTA report found that although coablation tonsillectomy resulted in lower post-operative pain than electrocautery for tonsillectomy, this reduction did not justify the additional cost. In a systematic review examining the use of EVS for vaginal hysterectomy, EVS equipment was found to be cost-saving due to the reduction in hospital length of stay. Compared to staplers and disposable clip appliers for colectomy, EVS was found to be more cost-effective in a randomized trial.

No relevant information pertaining to thermal spread or reusable versus single use vessel sealing devices was identified. Overall, although not all evidence is consistent, electrosurgical techniques for vessel sealing seem to be associated with reduced operative time and reduced blood loss in patients undergoing procedures such as hysterectomy, hemorrhoidectomy, knee and hip arthroplasty, and tonsillectomy. While EVS was associated with reduced post-operative pain in hysterectomy and
hemorrhoidectomy, electrosurgical techniques such as electrocautery were associated with higher postoperative pain in patients undergoing tonsillectomy. EVS was found to be more cost-effective for colectomy, cost-neutral for posterior instrumentation of the spine, and cost-saving for vaginal hysterectomy.
REFERENCES SUMMARIZED:

Health technology assessments


Systematic reviews and meta-analyses


Randomized controlled trials


**Economic evaluations**


Structured abstract available from:
http://www.mrw.interscience.wiley.com/cochrane/cleed/articles/NHSEED-22006006463/frame.html

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APPENDIX – FURTHER INFORMATION:

Review articles
