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Australia and New Zealand Horizon Scanning Network

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AN INITIATIVE OF THE NATIONAL, STATE AND TERRITORY GOVERNMENTS OF AUSTRALIA AND THE GOVERNMENT OF NEW ZEALAND

Horizon Scanning Technology

Prioritising Summary

Intraoperative ultrasonography for breast cancer surgery

May 2007

ASERNIP-S

Australian
Safety
and Efficacy
Register
of New
Interventional
Procedures -
Surgical

Royal Australasian
College of Surgeons

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PRIORITISING SUMMARY

REGISTER ID: **S000033**

NAME OF TECHNOLOGY: **INTRAOPERATIVE ULTRASONOGRAPHY**

PURPOSE AND TARGET GROUP: **TO ACHIEVE NEGATIVE MARGINS WITHOUT THE NEED FOR GUIDE WIRE DURING SURGICAL EXCISION OF BREAST CANCER**

STAGE OF DEVELOPMENT (IN AUSTRALIA):

- ☐ Yet to emerge
- ☐ Experimental
- ☐ Investigational
- ☐ Nearly established
- ☐ Established
- ☑ Established *but* changed indication or modification of technique
- ☐ Should be taken out of use

AUSTRALIAN THERAPEUTIC GOODS ADMINISTRATION APPROVAL

- ☐ Yes — ARTG number **N/A**
- ☐ No
- ☑ Not applicable

INTERNATIONAL UTILISATION:

COUNTRY	LEVEL OF USE		
	Trials Underway or Completed	Limited Use	Widely Diffused
Australia		✓	
Netherlands		✓	
United States		✓	

IMPACT SUMMARY:

Ultrasonography has many diagnostic and therapeutic applications which are widely used in medicine. Intraoperative ultrasonography to guide breast cancer excision appears to be a recent new application of the technology. Clinical studies suggest this new application of ultrasonography may lead to improved resection margins as well as offer further advantages to the surgeon and hospital.

BACKGROUND

The surgical treatment of breast cancer has undergone major developments in the past two decades. Breast-conserving surgery has gained wide acceptance by surgeons and in many cases is considered as an equal option to complete mastectomy (surgical removal of the entire breast) in treating early breast cancers (Harlow et al. 1999). Additionally, as a result of the increased use of mammography, breast cancers are being detected at their early stages even before they become palpable to the patient or clinician (Harlow et al. 1999).

Depending on the type and stage of development of the tumour, surgical treatment may include the excision of the tumour via lumpectomy (removal of the lump) or even mastectomy. The surgeon must ensure that the excised tissue has clear margins (i.e. no cancer in margin area) to be certain that the tumour has been completely removed. In the event clear margins have not been achieved, further tissue excision is performed by the surgeon to remove any remaining tumour. Despite being used as an indicator of successful tumour excision, the importance of margin status following excision and what actually constitutes an appropriate margin has been a source of debate in recent literature (Moore et al. 2001). It has also been noted that analysis of margins may be important in survival and local recurrence rates through the association of negative margins and minimally involved margins with favourable survival statistics (Moore et al. 2001).

In order for successful excision of the tumour through lumpectomy, the tumour must first be localised within the breast tissue. Currently, preoperative introduction of a wire into the breast by mammographic, stereotactic or ultrasound guidance is the gold standard method of tumour localisation (Snider et al. 1999). However, the use of wire localisation to guide surgical excision has drawbacks. Patients must endure significant pain and anxiety while the procedure is performed by a radiologist in the radiology department (Kelly and Winslow 1996). Additionally, accuracy is not always guaranteed as the wire is often not introduced directly above the lesion, forcing the surgeon to estimate the location of the tumour to plan the incision (Snider et al. 1999). The risk of missing the tumour during guide wire localisation has been reported to range from 0% to 22% (Snider and Morrison 1999). Importantly, use of wire localisation does not allow for an accurate determination of margin status (Smith et al. 2001), Furthermore, the requirement for the patient to travel from the radiology department to the operating room may lead to wire displacement as well as inefficiencies between the two sites (Kauffman et al. 2002).

Intraoperative ultrasonography for breast cancer surgery (lumpectomy) is a less traumatic technique for tumour localisation without the need for the use of a guide wire. The technique was first described in 1988 and can be carried out by either a radiologist or appropriately trained surgeon in the operating room (Schwartz et al. 1988). This method of visualisation is unique as it allows for visualisation of the tumour during the excision procedure at all times (Rahusen et al. 2002). Its use has the potential to not only reduce patient pain and anxiety but also make breast cancer surgery faster and more efficient as the requirement for use of equipment in the radiology department is no longer required. The technique can lead to the immediate assessment of margin status of the excised lesion and potentially reduce the number of re-excision resulting from positive margins (Smith et al. 2001). While not all lesions are able to be visualised with ultrasound, the majority are (Harlow et al. 1999). Lesions which are not well imaged by ultrasound include those consisting of micro-calcifications or speculations extending a distance from the tumour mass (Harlow et al. 1999). For these patients wire localisation with mammographic guidance may be a better alternative (Kaufman et al. 2002).

CLINICAL NEED AND BURDEN OF DISEASE

Breast cancer is the most common form of invasive cancer amongst Australian women (Paul et al. 1999). It is also the leading cause of cancer death in females. The incidence of breast cancer in Australia is on the increase with new cases increasing from 5,318 in 1983 to 12,207 new cases in 2002 (AIHW 2006). Furthermore it is estimated that the number of new cases will increase to 14,800 by 2011 (AIHW 2006).In 2002 the prevalence of breast cancer in Australia among Australian women was 113,801 females alive diagnosed with breast cancer in the previous 20 years (AIHW 2006).

DIFFUSION

Ultrasonography is a widely used application in medicine with both diagnostic and therapeutic uses. However its use intra-operatively during the surgical excision of breast cancers has only begun to be reported more frequently in the published literature in the last decade. As a result this application of ultrasonography may not be as widespread as other diagnostic and therapeutic applications. The current literature search conducted did not reveal the extent of diffusion of intraoperative ultrasonography during breast cancer surgery in Australia or internationally.

COMPARATORS

Alternative methods for pre-operative tumour localisation:

- Hook wire/Guide wire (Kopan's wire, Homer wire)
- Carbon injection method
- Radio-guided occult lesion localisation (ROLL)

SAFETY AND EFFECTIVENESS ISSUES

Rahusen and colleagues reported the results of a randomised clinical trial comparing margin clearance and lumpectomy size with ultrasonography-guided breast cancer excision versus the gold standard (wire-guided breast cancer excision) (Rahusen et al. 2002). The patients in this study included 49 women with non-palpable, mammographically detected breast lesions with an established diagnosis of invasive breast cancer identified by image-guided core needle biopsy[1] and ultrasonography. Patients randomised to receive wire-guided excision (n = 23) received placement of the guide wire the day before or on the morning of the surgery by a radiologist using ultrasonographic guidance. Patients who were randomised to receive ultrasonography guided excision (n = 26) were treated by both a surgeon and an experienced radiologist using a 10 MHz probe (HAD 3000, Advanced Technology Laboratories, Bothell, WA, United States). One patient randomised to wire-guided excision suffered displacement of the wire and underwent ultrasonographic guided excision. Immediately following excision, the resected specimens were checked by the radiologist in the operating room using ultrasonography. The mean operating time[2] was similar between both groups (66 minutes for ultrasound-guided group and 65 minutes for the guide-wire group). Similarly, there were no significant differences between groups in terms of mean lumpectomy weight and size (ultrasound-guided group: 1.34 cm and 51 g, guide-wire group: 1.36 cm and 53 g). Ultrasound-guided excision performed significantly better than guide-wire excision in terms of the achievement of adequate cancer-free margins (i.e. ≥ 1 mm). Twenty-four out of 27 patients (89%) who received ultrasonography achieved adequate margins of ≥ 1 mm compared to only 12 out of 22 patients (55%) in the guide-wire group (p = 0.007). Margins of

[1] Core needle biopsy: removal small of cylinder-shaped tissue sample from breast lesion.
[2] Operating time: measured from the start of disinfection to application of wound dressing, inclusive of sentinel node procedure but exclusive of any axillary lymph node dissection.

< 1 mm (close margins) were seen in two (7%) ultrasonography patients and six (27%) guide-wire patients (no significance test reported). Only one patient in the ultrasonography group attained focally positive margins compared to four in the guide wire group (no significance test reported).

In an earlier report Moore and colleagues published their results evaluating the efficacy of intraoperative ultrasound in obtaining adequate surgical margins in women undergoing lumpectomy for breast cancer (Moore et al. 2001). Unlike the report by Rahusen et al. (2002) the women included in this study all had palpable breast cancer. In this randomised controlled study fifty-one women with biopsy-proven infiltrating ductal carcinoma of the breast, stage T1 or T2, were randomised to receive either ultrasonography-guided excision (n = 27) or the standard excision procedure (n = 24). Patients randomised to receive the ultrasonography-guided excision were treated by the surgeon using a 7.5 MHz linear-array ultrasound probe (B&K Medical, Marlborough, MA, United States). Immediately following excision, the resected specimens were checked in the operating room using ultrasonography. If after checking it appeared that the margin was less than 1 cm, then additional breast parenchyma was resected. Patients who did not receive ultrasonography-guided excision received excision via the standard method (standard method not specified). There were no significant differences between groups in operating time (106 ± 37 minutes for ultrasonography group versus 121 ± 39 minutes for the control group, P = NS). Similarly, no significant difference between the groups was observed in terms of specimen size (104 ± 5.6 cm^3 for the ultrasonography group versus 114 ± 5.6 cm^3 for the control group, p = NS). In terms of the achievement of a desired margin, which in this study was 1 cm, only one ultrasonography patient presented with a positive margin, compared to seven patients (29%) in the control group ($p < 0.05$). All patients, with the exception of one control patient (who underwent further observation) who presented with positive margins underwent re-excision or mastectomy. Additionally the margin of uninvolved breast tissue was greater in the ultrasonography group (7.6 ± 2.0 mm) compared to the control group (4.8 ± 1.4 mm). Patients were also asked to evaluate their satisfaction with the cosmetic aspect of the surgery. Although no significant differences were detected, patients were generally satisfied with the outcome of the surgery with 25 out of 27 ultrasonography patients and 22 out of 24 control patients rating the procedure 4 or 5 on a 5-point scale.

COST IMPACT

If ultrasonography-guided excision is proven to be safe and effective it is likely that the procedure will lead to a reduction in hospital costs due to a reduced number of re-excisions and fewer mastectomies (Moore et al. 2001, Rahusen et al. 2002). Rahusen et al. (2002) also state that although the presence of a radiologist is not optimal in terms of the economics involved, their presence is still less costly than the wire-localisation procedure.

The Medicare Benefits Schedule reimbursement fees for procedures related to the surgical treatment of breast cancer in females are listed in Table 1:

Table 1: Medical Benefits Schedule of fees for procedures related to the surgical treatment of breast cancer in females (Department of Health and Ageing 2007)

Category	Item Number	Benefit (AUD)	Number of Claims (July 2005 to June 2006)
Total breast mastectomy	31518	$650.60	3,002
Subcutaneous breast mastectomy	31524	$919.25	718
Open surgical biopsy or excision of benign breast lesion up to and including 50 mm in diameter with or without frozen section histology	31500	$229.80	3,289
Excision of benign breast lesion more than 50 mm in diameter	31503	$306.45	729
Excision biopsy of breast abnormality where guidewire or other localisation procedure is performed	31506	$344.70	2,648
Open surgical biopsy of malignant breast tumour with or without frozen section histology	31509	$306.45	164
Complete local excision of malignant breast tumour with or without frozen section histology	31512	$574.55	5,527
Re-excision of following open biopsy or incomplete excision of malignant breast tumour	31515	$385.40	972
Preoperative localisation of lesion of breast by hookwire or similar device using interventional imaging techniques but not including imaging	31536	$167.35	5,847
Radiographic examination of excised breast tissue	59318	$47.05	4,536

ETHICAL, CULTURAL OR RELIGIOUS CONSIDERATIONS

No issues were identified from the retrieved material.

OTHER ISSUES

Intraoperative ultrasonography during breast cancer surgery requires the use of ultrasound equipment, therefore surgeons performing ultrasonography-guided excision should be well trained in the use of ultrasound and if necessary have a radiologist present to perform the ultrasonography (Harlow et al. 1999).

RECOMMENDATION:

Intraoperative ultrasonography to guide excision of breast cancers is not a new technique. At the time of writing it is unclear if intraoperative ultrasonography during breast cancer surgery is a technique regularly used by breast surgeons in Australia. The data presented have demonstrated promising results in achieving negative margins and potential advantages for patient, surgeon and hospital. Given the potential benefits to be gained through the widespread use of this technique it is recommended that a Horizon Scanning Report is produced.

SOURCES OF FURTHER INFORMATION:

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Snider H and Morrison D. Intraoperative ultrasound localization of nonpalpable breast lesions. *Annals of Surgical Oncology* 1999; **6**(3): 308-314.

LIST OF STUDIES INCLUDED

Total number of studies 2
Level II and III-2 intervention evidence

SEARCH CRITERIA TO BE USED

Breast surgery
Breast cancer
Excision
Lumpectomy
Ultraso$
Intraoperative
Intra-operative

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