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Horizon scanning prioritising summary

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Whole-body MRI: For the detection of metastases in patients with known malignant tumours.

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PRIORITISING SUMMARY

REGISTER ID: **000132**

NAME OF TECHNOLOGY: **WHOLE-BODY MRI**

PURPOSE AND TARGET GROUP: **FOR THE DETECTION OF METASTASES IN PATIENTS WITH KNOWN MALIGNANT TUMOURS**

STAGE OF DEVELOPMENT (IN AUSTRALIA):

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

AUSTRALIAN THERAPEUTIC GOODS ADMINISTRATION APPROVAL

☒	Yes	ARTG number	Not available
☐	No	☐	Not applicable

INTERNATIONAL UTILISATION:

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

IMPACT SUMMARY:

Large private and public health care institutions provide Magnetic Resonance Imaging (MRI) for the diagnosis and monitoring of a variety of health conditions, such as cancer. Several studies evaluated in this summary utilised a conventional MRI scanner with a rolling table platform to conduct whole-body scans, however Siemens AG manufacture the AVANTO MRI system, specifically for conducting whole-body MRI scans. The AVANTO system has approval from the Australian Therapeutic Goods Administration.

BACKGROUND

The success of oncology therapy depends on the type of primary cancer and also on the potential presence of secondary metastases. Metastatic disease may affect different anatomic regions of the body. Patients may need to undergo several examinations with different modalities such as computed tomography (CT), ultrasound, MRI and scintigraphy to accurately stage metastatic disease. Staging of metastatic disease is therefore time consuming and costly (Lauenstein et al 2004).

Whole-body MRI has recently been proposed for detecting the presence of metastases. The Siemens unique AVANTO MRI operates in the same manner as a conventional MRI, but can utilise up to 76 coils on 32 receivers, which enables a whole-body scan. This contrasts with conventional MRI, which is capable of scanning one region at a time and would require repositioning of patients and changing coils (Siemens 2004).

CLINICAL NEED AND BURDEN OF DISEASE

Cancer is one of the major causes of death in Australia. Excluding skin cancers other than melanoma, there were 85,231 new cancer cases and 35,466 deaths due to cancer in Australia in 2000. An estimated 253,085 potential years of life would be lost to the community each year as a result of people dying of cancer before the age of 75. Among all persons, the combination of cancers of the colon and rectum (12,405 new cases) was the most common cancer registered in the year 2000. Colorectal cancer, breast cancer (11,400), prostate cancer (10,512), melanoma (8,531) and lung cancer (8,060) together accounted for 60% of all these cancers (AIHW and AACR 2003). All cancers have the capability to metastasise, however, there are notable exceptions, which rarely, if ever metastasise. These include basal cell carcinoma, or cancers which are primarily locally invasive, such as primary brain cancers (Kohn 1993). The number of public hospital separations for all malignant neoplasms in the year 2002-03 totalled 2,208,968 and the number of separations for malignant neoplasms of ill-defined, secondary and unspecified sites (AR-DRG numbers C76-C80) was 39,934 for the same period (AIHW 2004).

DIFFUSION

The Royal Brisbane, Ballarat and Fremantle Hospitals are in the process of installing a Siemens AVANTO, whole-body MRI system. St Vincents Hospital in Melbourne have an established unit and have conducted a large number of whole-body scans (personal communication Siemens Australia).

COMPARATORS

Although scintigraphy is considered the clinical standard for the detection of bone metastases, it involves exposing the patient to high doses of ionising radiation and it is difficult to differentiate degenerative disease and healing fractures, from metastatic disease (Lauenstein et al 2002). The most frequently used diagnostic imaging tool for cancers are CT scans, which provide anatomical information in respect to abnormal pathologic changes. CT scans also expose the patient to ionising radiation in the form of X-rays. CT scans may be limited in the detection of lesions that do not have good contrast with the surrounding tissue (Hany et al 2002). Therefore patients may receive a large radiation dose during an investigation for the presence of metastatic disease.

Conventional MRI is used to image internal structures, particularly soft tissues, muscles, nerves, brain, cardiovascular system, tumours and the spinal cord. It utilises a large magnetic field to polarise hydrogen atoms in the tissues. The summation of the energy released when the atoms are returned to their natural state produces an image for analysis. Conventional MRI may take as long as between 20-45 minutes (FASEB 2002).

EFFECTIVENESS AND SAFETY ISSUES

The comparative study by Lauenstein et al (2004) examined 51 patients with known malignant tumours with whole-body MRI (diagnostic level of evidence 2). Utilising a rolling table platform, patients are moved rapidly through the bore of the scanner . Reference standards were CT scans for brain, thorax and abdomen imaging, and scintigraphy for imaging of the skeletal system. The mean examination time for whole-body imaging was 14.5 ± 2.8 minutes, including patient positioning and acquisition of all data sets. Images were read by two independent radiologists. All cerebral, pulmonary and hepatic metastases greater than 6mm in diameter were identified using whole-body MRI. Further, MRI detected a hepatic metastasis that was missed by CT, and identified 24 patients with osseous metastases, whereas scintigraphy detected only 21 of these patients. Eight patients were negative for metastases after a whole-body MRI and these patients had no evidence of metastases at six months follow-up. Whole-body MRI failed to detect a pulmonary metastasis in one patient, however skeletal metastases were detected in this patient; therefore therapy of this patient

remained unchanged. Whole-body MRI performed on a per-patient basis had a sensitivity and specificity of 100 per cent compared to CT and scintigraphy.

An earlier study by Lauenstein (2002) conducted whole-body MRI on 26 patients with known or suspected bone metastases, compared to the reference standard, scintigraphy (diagnostic level of evidence 2). Scintigraphy detected bone metastases in 16/26 patients (62%) and metastases were present in 60 of the 286 analysed regions. Whole-body MRI had a patient-based sensitivity of 100 per cent as it detected bone metastases in the same 16 patients and MRI detected bone metastases in additional two patients (patient-based specificity 80%). However, whole-body MRI detected only 53 of the 60 regions identified by scintigraphy, resulting in a region-based sensitivity of 88 per cent. Whole-body MRI detected 28 regions with metastases that were negative by scintigraphy, resulting in a region-based specificity of 88 per cent.

The comparative study by Daldrup-Link et al (2001) reported on 39 young adults and children with primary tumours, that were likely to metastasise to bone. Patients underwent whole-body MRI, skeletal scintigraphy and positron emission tomography, compared to the reference standard, histopathology (diagnostic level of evidence 2). Results are shown in Table 1.

Table 1 Sensitivity for detection of bone metastases

	Number of patients (n=39)			Number of lesions (n=51)		
	MRI	SSC	PET	MRI	SSC	PET
True negative	18	18	16	NA	NA	NA
True positive	16	16	18	42	36	46
False negative	5	5	3	9	15	5
False positive	0	0	2	3	3	6
Sensitivity (%)	76	76	86	82	71	90

SSC = scintigraphy, NA = not applicable, PET = positron emission tomography

COST IMPACT

Whole body MRI is currently not covered by a single Medicare Benefits Schedule item number. All MRI scans utilise a contrast agent, which is covered by the MBS item number 63491 ($44.80). Conducting a MRI scan for the detection of tumours in the brain and spine (MBS item numbers 63001 and 63201 respectively) attracts a fee of $403 and $448, respectively. MBS item number 63301 (fee $380) may be used to conduct an MRI scan on bone or the musculoskeletal system, but not if the primary tumour is in the breast, prostate or rectum. To screen a patient for metastases from a primary breast, prostate or rectal tumour the fee is $896 and unknown primary tumours may be billed at $1657.60. Whole body screening scans would use a similar amount of scan room and technician time compared to a single region examination, but may require 20 minutes extra for post processing (personal communication Greg Brown[1]).

The AVANTO MRI system is estimated to cost between $2-2.5 million (personal communication Siemens Australia).

ETHICAL, CULTURAL OR RELIGIOUS CONSIDERATIONS

No issues were identifies/raised in the sources examined.

[1] Greg Brown (SMRT) is the senior radiographer, MRI Research and Development, Radiology, Royal Adelaide Hospital

CONCLUSION:

Whole-body MRI appears to be an emerging technique in Australia, however it is not currently itemised on the Medicare Benefits Schedule. It is likely that whole-body MRI scans are currently being charged as several single MBS items.

HEALTHPACT ACTION:

Based on the high level of evidence available and the need in the Australian health system, it is recommended that a Horizon Scanning report be conducted.

SOURCES OF FURTHER INFORMATION:

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Eustace, S., Tello, R. et al (1997). 'A comparison of whole-body turboSTIR MR imaging and planar 99mTc-methylene diphosphonate scintigraphy in the examination of patients with suspected skeletal metastases', *AJR Am J Roentgenol,* 169 (6), 1655-1661.

FASEB (2002). *Magnetic resonance imaging* [Internet]. Federation of American Societies for Experimental Biology (FASEB). Available from: http://www.faseb.org/opa/mri/default.htm [Accessed 7th April 2004].

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Kohn, E. C. (1993). 'Development and prevention of metastasis', *Anticancer Res,* 13 (6B), 2553-2559.

Lauenstein, T. C., Freudenberg, L. S. et al (2002). 'Whole-body MRI using a rolling table platform for the detection of bone metastases', *Eur Radiol,* 12 (8), 2091-2099.

Lauenstein, T. C., Goehde, S. C. et al (2004). 'Whole-Body MR Imaging: Evaluation of Patients for Metastases', *Radiology,* 233 (1), 139-148.

Siemens (2004). *Magnetom Avanto* [Internet]. Siemens AG. Available from:http://www.medical.siemens.com/ [Accessed 7th October 2004].

SEARCH CRITERIA TO BE USED:

Neoplasms
Magnetic Resonance Imaging
Sensitivity and Specificity
Comparative Study
Radiopharmaceuticals/*diagnostic use
Tomography, Emission-Computed