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Australia and New Zealand Horizon Scanning Network

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# National Horizon Scanning Unit
## Horizon scanning prioritising summary

## Volume 2, Number 7:

# Ultrafast Magnetic Resonance Imaging (MRI): For patients undergoing conventional MRI.

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# PRIORITISING SUMMARY

**REGISTER ID:** **0000045**

**NAME OF TECHNOLOGY:** **ULTRAFAST MAGNETIC RESONANCE IMAGING (MRI)**

**PURPOSE AND TARGET GROUP:** **PATIENTS UNDERGOING CONVENTIONAL MRI**

**STAGE OF DEVELOPMENT (IN AUSTRALIA):**

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

**AUSTRALIAN THERAPEUTIC GOODS ADMINISTRATION APPROVAL**

| | | | |
|---|---|---|---|
| ☒ | Yes | ARTG number | 43663 |
| ☐ | No | ☐ | Not applicable |

**INTERNATIONAL UTILISATION:**

| COUNTRY | LEVEL OF USE | | |
|---|---|---|---|
| | Trials Underway or Completed | Limited Use | Widely Diffused |
| Comparative study, stroke, United Kingdom | ✓ | | |
| Comparative study, congenital abnormalities, Japan | ✓ | | |
| Comparative study, pediatric neuroradiology, United Kingdom | ✓ | | |

**IMPACT SUMMARY:**

Several companies, such as Siemens, Phillips and GE, manufacture ultrafast magnetic resonance imaging (MRI) systems. Currently the GE Medical Systems MRI, Signa Infinity series has TGA approval (ARTG number 43663).

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 force, which polarises hydrogen atoms in the tissues. The summation of these energies produces an image for analysis. Conventional MRI may take as long as between 20-45 minutes.

Ultrafast MRI utilises multi channel (eight), phase-array brain coils, which increase the speed of image gathering but does not reduce the quality of the images. Conventional MRIs may be used in a rapid format but this has the effect of reducing the quality of the image.

Ultrafast MRI has been cited as a useful diagnostic tool for patients suspected of suffering a stroke. In the abstract presented to the Radiological Society of North America, Trivedi et al (2003) compared conventional MRI to ultrafast MRI in 24 patients referred with a clinical

diagnosis of acute middle cerebral arterial (MCA) stroke. Conventional MRI detected occlusion in 7 patients, whereas ultrafast MRI detected 6 of these 7 cases (sensitivity 86%, specificity 94%, p=0.0001). The ultrafast MRI protocol took 3 minutes to perform and the conventional MRI took 20 minutes. Anti-thrombolytic therapy should begin within 3 hours after stroke onset, therefore this saving in time to reach a diagnosis may be crucial in respect to successful treatment of stroke patients. It should be noted, however, that in urgent "likely" stroke cases, conventional MRI would be utilised rapidly, sacrificing the quality of image to ensure a rapid diagnosis (personal communication Greg Brown, senior radiographer RAH).

Approximately 40,000 Australians suffer a stroke each year in Australia with 50% of strokes occurring in those aged over 75 years. In 1998 a survey found that an estimated 64,000 Australians suffer a disability whose main cause was stroke. In 2000-01 there were 52,930 hospital admissions for stroke and it is the second most common cause of death among Australians with 25% of all people who experience a stroke dying within one month (AIHW 2003). Many of these patients would undergo a conventional MRI or an ultrafast MRI (were it available).

Ultrafast MRI has also been utilised for pediatric neuroradiology and as an adjunct to ultrasound in the prenatal diagnosis of congenital abnormalities. Singh et al (2003) conducted a study to detect intracranial abnormalities in 125 children. Overall sensitivity was 78%, specificity 98% with positive and negative predictive values of 98% and 76% respectively when ultrafast MRI was compared to conventional MRI. Ultrafast MRI may be reduce the need for anaesthesia necessary for standard scans with conventional MRI in small children.

The cost of a complete ultrafast MRI system, such as the Siemens Ltd Tesla Magnetic Resonance (MR) system, which incorporates Total imaging matrix (Tim™) technology, is estimated to be A$2.7 million. It is estimated that cost savings would be made in the hospital setting for patients requiring non-urgent MRIs as the ultrafast system is able to process patients in a shorter time span, which should be reflected in an increased number of patients able to access MRI.

## CONCLUSION:

Based on the clinical need for, and the existing level of, utilisation of conventional MRI it is expected that ultrafast MRI will diffuse rapidly throughout the Australian health system.

## HEALTHPACT ACTION:

Therefore it is recommended that this technology be monitored.

## SOURCES OF FURTHER INFORMATION:

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Hubbard, A. M. (2003). 'Ultrafast fetal MRI and prenatal diagnosis', *Semin Pediatr Surg*, 12 (3), 143-153.

Matsuoka, S., Takeuchi, K. et al (2003). 'Comparison of magnetic resonance imaging and ultrasonography in the prenatal diagnosis of congenital thoracic abnormalities', *Fetal Diagn Ther*, 18 (6), 447-453.

Singh, R. K., Smith, J. T. et al (2003). 'Ultrafast MR imaging in pediatric neuroradiology', *Acta Radiol*, 44 (5), 550-557.

Trivedi, R., U-King-Im, J. et al (2003). 'Ultrafast Imaging in Acute Stroke: Utility of an Integrated Three-minute Neuro MR Protocol', Conference Proceeding:

Radiological Society of North America, Chicago, In: *Ultrafast Imaging in Acute Stroke: Utility of an Integrated Three-minute Neuro MR Protocol.*

**SEARCH CRITERIA TO BE USED:**

Magnetic Resonance Imaging/*methods
Fetal Diseases/*diagnosis
Abdominal Neoplasms/diagnosis
Central Nervous System/abnormalities/embryology
*Prenatal Diagnosis
Thoracic Diseases/diagnosis
Thorax/abnormalities/embryology
Infarction