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Horizon Scanning Technology Prioritising Summary

MRI for the diagnosis of rheumatoid arthritis

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AHTA

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PRIORITISING SUMMARY

REGISTER ID: **000356**

NAME OF TECHNOLOGY: **MRI FOR THE DIAGNOSIS OF RHEUMATOID ARTHRITIS**

PURPOSE AND TARGET GROUP: **PATIENTS WITH EARLY RHEUMATOID ARTHRITIS**

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	Many MRI scanners are approved by the TGA. These could be used for RA diagnosis.
☐	No	
☐	Not applicable	

INTERNATIONAL UTILISATION:

COUNTRY	LEVEL OF USE		
	Trials Underway or Completed	Limited Use	Widely Diffused
Denmark		✓	
New Zealand	✓		
Germany	✓		
USA		✓	
UK		✓	

IMPACT SUMMARY:

Clinics and hospitals equipped with MRI capabilities would provide early diagnosis of rheumatoid arthritis (RA). The advent of small office based MRI machines may provide a more accessible and cheaper mode of diagnosis and monitoring of RA patients. Diagnosis at an early stage may allow RA to be treated earlier and therefore minimise the degenerative effects of the disease. As the degenerative effects are often not reversible and cumulative, early detection of RA is a priority. Wider access to MRI would allow the monitoring of patients undergoing therapy. Based on this monitoring better clinical decisions could be made to maximise the delay before RA induced disability occurs.

BACKGROUND

Rheumatoid arthritis (RA) is a systemic inflammatory disease caused by the immune system inappropriately attacking the host tissue. The immune attack on joint tissue leads to the characteristic swollen, inflamed and painful joints. This eventually leads to degradation of the joints and hence lessened mobility and deformation of the joints. RA also affects other organs such as blood vessels, the skin, lungs, muscles and heart. There is evidence that major damage to the joints occurs in the early stage of the disease and, as this damage is irreversible and cumulative, its prevention should be a priority. Hence diagnosis at an early stage is important so that patients can be treated with existing therapies. Several drugs have been shown to be effective in preventing or reducing joint damage therefore limiting downstream symptoms such as loss of mobility and joint function. The long term effects of these drugs have not been fully elucidated and patient monitoring is necessary to determine the drug's effectiveness or adverse events caused by them. MRI is emerging as a tool to both diagnose patients who may have RA and monitor those who are diagnosed and placed on therapy.

CLINICAL NEED AND BURDEN OF DISEASE

Rheumatoid arthritis is a major disease burden in Australia. The prevalence of RA in Australia has been calculated to be 2.5 per cent of the population in 2007 based on (AE 2007). RA is Australia's most prevalent autoimmune disease and affects women more than men with an estimated 57.1 per cent of RA sufferers being women. The onset of RA generally occurs between 25-50 years of age and given the debilitating effects of RA, the loss of QALYs[1] and productivity is significant. There is a significant impact on the work ability of more than half of RA patients after 10 years of disease, this can be either reduction of working time or complete cessation of work due to disability (AE 2007). In 2007 an estimated $ 405 million was allocated to expenditure on RA in the Australian health care system. Of expenditure for all arthritic conditions, 3.5 and 16.1 per cent of hospital inpatient and outpatient expenditure, respectively, is attributable to RA.

DIFFUSION

No evidence of MRI being used in early diagnosis of RA was found in literature searches conducted for this summary.

COMPARATORS

The diagnosis of RA in its early stages is difficult due to the non-specific and variable symptoms. RA is diagnosed using several clinical and test based markers. For a definitive diagnosis of RA at least four of the seven conditions must be met from the following table (AIHW 2005).

[1] QALY = quality adjusted life year

Table 1 American College of Rheumatology rheumatoid arthritis diagnostic criteria

	Criteria	Comment
1	Morning stiffness	Duration > 1 hour; lasting > 6 weeks
2	Arthritis of at least 3 areas	Soft tissue swelling or exudation lasting > 6 weeks
3	Arthritis of hand joints	Wrist, metacarpophalangeal joints or proximal interphalangeal joints lasting > 6 weeks
4	Symmetrical arthritis	At least one area, lasting > 6 weeks
5	Rheumatoid nodules	As observed by a physician
6	Serum rheumatoid factor	As assessed by a method positive in less than 5% of control subjects
7	Radiographic changes	As seen on anteroposterior films of wrists and hands

Source: (AIHW 2005)

SAFETY AND EFFECTIVENESS ISSUES

MRI can be used to measure the extent of synovitis and bone erosion within the examined joint of the RA patient. The advantage of MRI over conventional X-ray based imaging is its ability to identify damage in the soft tissue, which is not easily visible in X-ray radiographs. The first study describing the use of MRI compared to conventional radiography (CR) reported erosions in 45 per cent of early RA patients, whereas CR was only sensitive enough to detect bone erosions in 15 per cent of patients. In this study 42 consecutively recruited patients were examined with both CR and MRI. All patients were in the early stages of RA with symptoms present for less than six months. A 1.5 Tesla scanner was used for the MRI diagnoses (McQueen et al 1998) (Level III-2 diagnostic evidence).

Using computed tomography (CT) as the reference standard a small study involving 17 RA patients and 4 controls compared MRI, US and CR. The aim of the study was to investigate whether bone erosions visualised in MRI and US but not on CR were true erosions. For erosions detected by CT, MRI showed sensitivity, specificity and accuracy of 68, 96 and 98 per cent. The joints which did not show erosion in CR but did show erosion in MRI were found by CT to be truly eroded in 96 per cent of cases. As CT was the reference standard, soft tissue damage could not be compared (Dohn et al 2006) (Level III-2 diagnostic evidence).

Most MRI studies have used either 1.5 or 3.0 T MRI scanners. The availability, cost and size of these machines limits the applicability of MRI diagnosis of early RA. Consequently, several small, office based 0.2 T MRI scanners are now available and can be used for RA diagnosis. In a study of 17 RA patients the diagnostic capability of conventional 1.5 T MRI scanning was compared to 0.2 T analysis. A good to excellent (kappa 0.74 to 0.94) correlation for synovitis and erosions, was obtained

with both MRI scanners, while the agreement for tenosynovitis was moderate (kappa 0.51 to 0.65). While overall there was good agreement between the two MRI modalities the study was small in size and as such the results should be interpreted with caution (Schirmer et al 2007) (Level III-2 diagnostic evidence).

Different strategies for MRI diagnosis of disease progression were investigated in a study which recruited 35 RA patients (median age 55 years: RA disease duration 5 years) and nine healthy controls. Two MRI approaches were used, one which evaluated many joints and the other which evaluated few joints. The results from these two strategies were compared to conventional radiography. Patients were given baseline tests and re-examined one year later. Both MRI approaches were found to be significantly better (25 patients with progression detected, $p < 0.001$) at detecting progression over one year compared to CR (9 patients with progression detected) (Ejbjerg et al 2005) (Level III-2 diagnostic evidence).

A recent study compared conventional radiography (CR) and ultrasound (US) using MRI as the reference standard. The population consisted of 40 RA and 20 control patients (5 years median RA disease duration; median age 58). For the assessment of bone erosion, ultrasound had sensitivity, specificity and accuracy[2] of 59, 98, and 96 per cent respectively when compared to MRI. In the same comparison CR showed sensitivity, specificity and accuracy of 42, 99 and 95 per cent versus MRI. Soft tissue involvement was most accurately detected by MRI with the relative sensitivity, specificity and accuracy of US being 70, 78 and 76 per cent respectively. CR sensitivity, specificity and accuracy relative to MRI was 40, 85 and 72 per cent, respectively (Szkudlarek et al 2006) (Level III-2 diagnostic evidence).While this is not a direct measure of the effectiveness of MRI, the results clearly show that both CR and US are not as sensitive as MRI . Additionally, MRI was more effective at visualising soft tissue involvement.

None of the reports examined for this prioritising summary reported any adverse or safety related incidents.

In summary, most of the MRI diagnostic studies for RA have small patient populations, often lack any form of blinding or control groups, and long term follow up and patient outcomes are not investigated nor reported. Despite this, the evidence which is available shows that MRI appears to be the best available diagnostic technique for RA. Additionally MRI can be used to monitor patient disease progression. MRI has the advantage over X-ray based imaging in that it allows the visualisation of both bone and soft tissue, both of which are extensively involved in RA. Further large scale assessments of MRI are needed before definitive conclusions about its effectiveness can be drawn.

[2] Accuracy is the overall agreement in diagnosis when compared to MRI

COST IMPACT

No cost information was reported in the studies examined.

ETHICAL, CULTURAL OR RELIGIOUS CONSIDERATIONS

No issues were identified/raised in the sources examined.

OTHER ISSUES

No issues were identified/raised in the sources examined.

SUMMARY OF FINDINGS

Based on the limited evidence available MRI appears to be the best diagnostic test for diagnosis and progression monitoring of RA, especially in early stage RA patients where interventions stand the best chance of producing cost-effective outcomes. Other imaging techniques do not provide the same resolution (ultrasound) or do not image all of the appropriate tissues (CT and X-ray radiography).

HEALTHPACT ACTION:

With the increased use of TNFα inhibitors for the early treatment of rheumatoid arthritis, early diagnosis of this disease is desirable. Therefore HealthPACT have recommended that this technology be monitored in 12 months time. There is also considerable interest in the use of office-based 0.2-0.5 tesla MRI units for the diagnosis of bone and joint disease. Therefore HealthPACT have recommended that a Prioritising Summary be commissioned on this subject.

NUMBER OF INCLUDED STUDIES

Total number of studies	
Level III-2 diagnostic evidence	5

REFERENCES:

AE (2007). *Painful Realities: The economic impact of arthritis in Australia in 2007,* Access Economics for Arthritis Australia,

AIHW (2005). *Arthritis and musculoskeletal conditions in Australia 2005,* Australian Institute of Health and Welfare,

Dohn, U. M., Ejbjerg, B. J. et al (2006). 'Are bone erosions detected by magnetic resonance imaging and ultrasonography true erosions? A comparison with computed tomography in rheumatoid arthritis metacarpophalangeal joints', *Arthritis Res Ther,* 8 (4), R110.

Ejbjerg, B. J., Vestergaard, A. et al (2005). 'The smallest detectable difference and sensitivity to change of magnetic resonance imaging and radiographic scoring of structural joint damage in rheumatoid arthritis finger, wrist, and toe joints: a comparison of the OMERACT rheumatoid arthritis magnetic resonance imaging score applied to different joint combinations and the Sharp/van der Heijde radiographic score', *Arthritis Rheum,* 52 (8), 2300-2306.

McQueen, F. M., Stewart, N. et al (1998). 'Magnetic resonance imaging of the wrist in early rheumatoid arthritis reveals a high prevalence of erosions at four months after symptom onset', *Ann Rheum Dis,* 57 (6), 350-356.

Schirmer, C., Scheel, A. K. et al (2007). 'Diagnostic quality and scoring of synovitis, tenosynovitis and erosions in low-field MRI of patients with rheumatoid arthritis: a comparison with conventional MRI', *Ann Rheum Dis,* 66 (4), 522-529.

Szkudlarek, M., Klarlund, M. et al (2006). 'Ultrasonography of the metacarpophalangeal and proximal interphalangeal joints in rheumatoid arthritis: a comparison with magnetic resonance imaging, conventional radiography and clinical examination', *Arthritis Res Ther,* 8 (2), R52.

SEARCH CRITERIA TO BE USED:

Arthritis, Rheumatoid/ diagnosis
Magnetic Resonance Imaging/standards