Diagnostic Accuracy of Magnetic Resonance Myocardial Perfusion Imaging for diagnosis of functionally significant obstructive coronary artery disease. A systematic review

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Background:

Ischaemic heart disease (IHD) as a consequence of untreated Coronary arterial disease (CAD) is one of the top three causes of mortality and the most common cause of morbidity in developed countries, therefore early diagnosis is important.

Cardiac magnetic resonance perfusion imaging(CMR) is one of the non-invasive techniques that had shown to be safe in diagnosis of haemodynamically obstructive intraluminal coronary lesion.

Several small studies have evaluated diagnostic performance of CMR and some have been included in previous meta-analysis (Mahon M,2010 and Nandalur KR,2007) which compared it to Quantitative Coronary angiogram(QCA).

Objective

Due to the fact that QCA often provides insufficient information regarding physiological significant of the coronary lesions we performed a contemporary meta-analysis of CMR diagnostic accuracy compared with an invasive pressure-wire guided fractional flow reserve as a reference standard.

Methods:

(a) Literature search
Systematic review methods were used to identify, analyse and synthesise data. A search of the electronic databases for published academic and grey literature articles published before November 2012 in MEDLINE, COCHRANE, BMC, Google Scholar, SCOPUS and PubMed. Reference lists of all retrieved papers were also extensively crosschecked to supplement the list of articles.

(b) Quality assessment and statistical analysis
•All the studies were closely assessed by QUADAS-2 (Quality Assessment of diagnostic Accuracy studies).
•*Kohen* Kappa was used to calculate inter-rater reliability
•Using Meta-Disc software, pooled diagnostic odd ratios (DOR), sensitivity, specificity and positive likelihood ratio were calculated. Summary of receiver operator characteristics (SROCs) curves were also constructed to calculate areas under the curve (AUCs)

Results:

(a)Study selection and studies characteristics

A total of 9 prospective studies involving 568 patients were included in this review from initial screening of 14836 tittles (See figure 1).

The nine studies included a total of 568 patients (patient's age ranged from 18 to 90), 1362 coronary arteries and 1802 CMR and Coronary angiogram guided FFR tests. Neither randomised control trial nor prognostic or outcome studies were found.
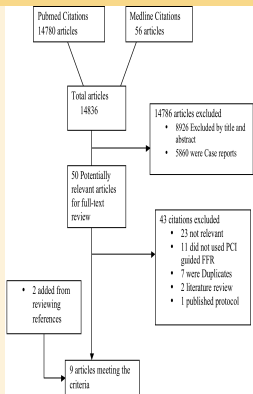

Figure 1: flow chart of selection of eligible studies

Results

Methodological Quality assessment
Using the QUADAS-2 tool showed that most studies are of LOW RISK of bias and both index test and reference standard test are easily applicable. The overall inter-rater reliability calculated in terms Cohen kappa k was 0.852 (95% CI 0.712 to 0.992) (very good) regarding concerns in applicability and 0.778 (95% CI 0.663 to 0.923) (good) for assessment regarding risk of bias
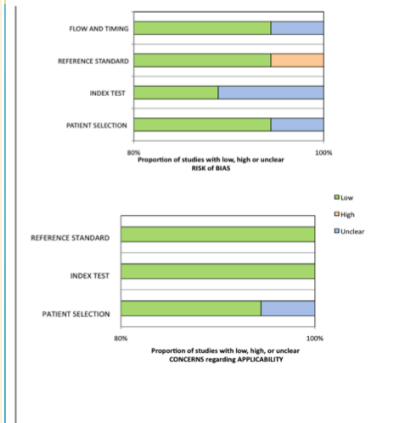
Diagnostic accuracy (performance indexes and summary estimates)

Using Meta-Disc 1.4 software we calculated individual and pooled sensitivity, specificity, PLR, NLR, DOR on the basis of coronary territory and patient basis compared cut-FFR <0.75 and <0.8

Fig 3b:Pooled sensitivity and specificity of CMR on the basis of patients.

The pooled sensitivity and specificity were 93% (95% CI 89% - 96) and 86% (95% CI 81%- 90%) respectively. The +LR, -LR and DOR at 95% CI were 6.47 (4.47- 9.03), 0.09 (0.06-0.64) and 74.1 (39.4-139.3) respectively
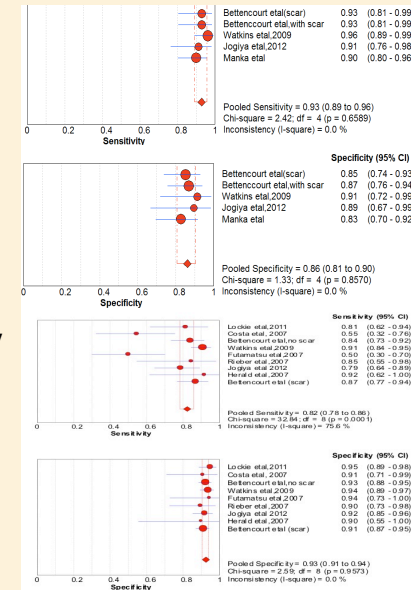
Figure 3c: Pooled sensitivity and specificity of CMR of basis coronary artery.
The pooled specificity was 92.5% (95% CI; 90.7% -94.1%) and the calculated pooled sensitivity using random effect model (ROM) was 82.3% (78.2%-85.9; 95% at CI)

Conclusion

CMR perfusion still shows both high sensitivity and specificity in detection of haemodynamically obstructive intra-luminal stenotic lesion in patient with known or suspected CAD. As it is non-invasive and does not expose patients to ionizing radiation it can be used as an alternative to invasive pressure-wire guided FFR to select patient who need revascularisation. Its high negative predictive value and low negative likelihood ratio suggest increased accuracy in ruling out lesions that are not haemodynamically significant.

References :
on request