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CGM@MRI

Direct comparison of cardiogoniometry with perfusion cardiac magnetic resonance and late gadolinium enhancement

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Background:

Stress testing for detection of coronary artery disease (CAD) in the outpatient setting is frequently hampered by the limited physical capacity of patients and the complexity of pharmacological stress imaging. Rest ECG however yields only low sensitivity and specifity in this context. Cardiogoniometry (CGM) is a novel electrodiagnostic method utilizing computer-assisted 3-dimensional information of cardiac potentials for detection of CAD. It is performed at rest, simple to use and fast to apply. The aim of this study was to determine the level of agreement between CGM and perfusion cardiac magnetic resonance in combination with late gadolinium enhancement.

Methods:

Forty patients with suspected or known stable CAD underwent CGM before cardiac magnetic resonance (CMR) imaging including adenosine stress perfusion (140ug/min/kg) and late gadolinium enhancement (3D inversion recovery technique). CMR images were analyzed visually and blinded to the CGM results, whereas CGM analysis is fully automated. CGM findings were compared against pathological perfusion and/or presence of late enhancement during CMR

Fig. 1

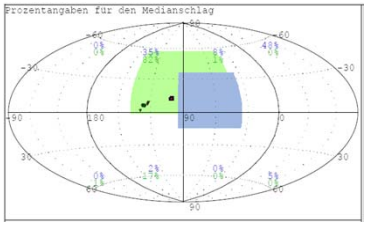

Fig. 2

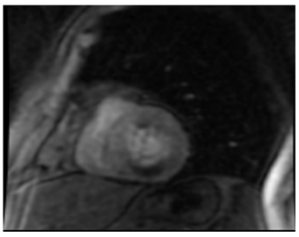

Fig. 3

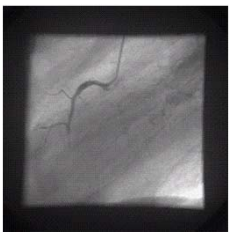

Fig. 1-3 Example of a pathological CGM corresponding to a defect on perfusion cardiac MR due to a collateralized chronic total occlusion of right coronary artery

Results:

Table 1. **Baseline clinical characteristics of patients presenting for perfusion cardiac magnetic resonance and late gadolinium enhancement examination (n = 40)**

Age (yrs.)	65±11	Known coronary artery disease	66%
Female gender	35%	Previous myocardial infarction	24%
Diabetes	13%	Previous PCI	55%
Current smoker	10%	Previous CABG	10%
Arterial hypertension	90%	Peripheral artery disease	8%
Hyperlipidemia	64%	Previous stroke / TIA	13%
Known coronary artery disease	66%	Reduced global ejection fraction	13%

Data are presented as mean value ±SD or percentage of patients.
CABG = coronary bypass graft, PCI = percutaneous coronary intervention, TIA = transitory ischemic attack
Ejection fraction measured by any method (no patient with EF < 40%

Table 2. **Rest ECG and echocardiographic findings**

No pathological findings on rest ECG	72% (n = 28/39)
Rest ECG with path. Q-waves, R-reduction and/or pers. ST-seg. elevation	13% (n = 5/39)
Rest ECG with any type of bundle branch block	10% (n = 4/39)
Left anterior hemiblock	5% (n = 2/39)
Left bundle branch block	3% (n = 1/39)
Right bundle branch block	3% (n = 1/39)
Bifascicular block	0% (n = 0/39)
Rest ECG with negative T-Waves and/or ST-segment depression	10% (n = 4/39)
Regional wall movement abnormality on echo	23% (n = 7/30)

Data are presented as absolute numbers and percentage of patients

Fig. 4

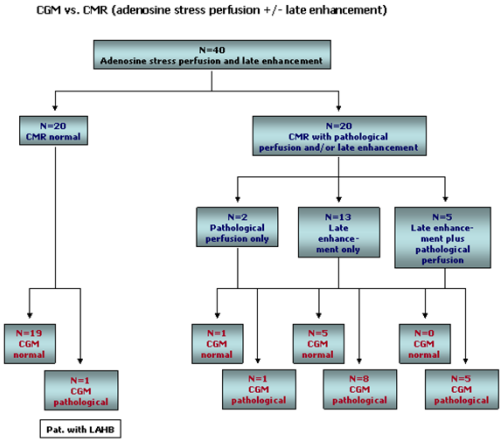

Table 3. **Diagnostic yield of cardiogoniometry and rest ECG compared to physiological or pathological findings on cardiac MR perfusion and/or late enhancement**

	CGM	Rest ECG Q-waves and/or R-reduction only	Rest ECG Negative T-waves and/or ST-segment-depression only	Rest ECG Q-waves, R-reduction, negative T-waves and/or ST-segment-depression	Rest ECG any kind of block	Rest ECG any kind of abnormality
Sensitivity	70% (n = 14/20)	25% (n = 5/20)	15% (n = 3/20)	35% (n = 7/20)	10% (n = 2/20)	40% (n = 8/20)
Specifity	95% (n = 19/20)	100% (n = 19/19)	95% (n = 18/19)	95% (n = 18/19)	89% (n = 17/19)	84% (n = 16/19)
Positive predictive value	93% (n = 14/15)	100% (n = 5/5)	75% (n = 3/4)	88% (n = 7/8)	50% (n = 2/4)	73% (n = 8/11)
Negative predictive value	76% (n = 19/25)	56% (n = 19/34)	51% (n = 18/35)	58% (n = 18/31)	49% (n = 17/35)	57% (n= 16/28)
Accuracy	83% (n = 33/40)	62% (n = 24/39)	54% (n = 21/39)	64% (n = 25/39)	49% (n = 19/39)	67% (n = 24/39)

Data are presented as absolute numbers and percentage of patients

Conclusion:

In this preliminary study CGM compares favourably to the combination of adenosine stress perfusion and late gadolinium enhancement for the detection of stable coronary artery disease and clearly outperforms rest ECG. Given the simplicity of this new approach it deserves further investigation in larger series.

Disclosures: R. Birkemeyer, R. Toelg, R. Wessely and U. Zeymer received speaker fees from Enverdis company