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REGIONAL VARIATION IN MYOCARDIAL BLOOD FLOW IN PATIENTS WITH LEFT BUNDLE BRANCH BLOCK: A QUANTITATIVE PERFUSION CMR STUDY

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Introduction Left bundle branch block is often associated with underlying coronary artery disease (CAD) but its presence can limit the diagnostic accuracy of non-invasive imaging tests. In particular, there is a high incidence of false-positive results with exercise single-photon emission CT (SPECT) due to apparent septal perfusion defects. The use of vasodilator stress has reduced but not eliminated this problem. Several hypotheses have been postulated to explain the cause of such perfusion defects, and these include: early activation of the septum leading to shortened diastole and reduced blood flow, partial volume effects caused by impaired septal thickening, and increased septal intra-myocardial pressure during diastole resulting in reduced flow reserve. A number of small studies using positron emission tomography (PET) or early quantitative SPECT techniques have evaluated regional differences in myocardial blood flow (MBF) in patients with LBBB, but the results have been conflicting and have shown either no regional differences or a relative but not absolute reduction in septal perfusion. This study re-evaluates the unresolved question of septal perfusion in LBBB by using quantitative perfusion CMR.

Methods 9 patients with LBBB and no significant CAD underwent adenosine stress/rest perfusion CMR at 1.5 T and X-ray angiography. Absence of CAD was defined as luminal stenosis <40% on quantitative coronary angiography in all major vessels. Mid-ventricular perfusion data were segmented into three regions for each patient: septal, adjacent (anterior-inferior) and lateral. MBF and myocardial perfusion reserve (MPR) were then determined for the septal and lateral regions by Fermi function deconvolution.

Results Resting MBF was similar in both septal and lateral regions in all patients (1.27 ± 0.26 vs 1.27 ± 0.23 ml/g/min; p=0.95)

Table 1

Patient	STRESS-Septal MBF (ml/g/min)	STRESS-Lateral MBF (ml/g/min)	REST-Septal MBF (ml/g/min)	REST-Lateral MBF (ml/g/min)	MPR-Septal	MPR-Lateral
1	4.73	4.83	1.42	1.46	3.33	3.31
2	2.56	3.33	0.91	1.11	2.81	3.00
3	3.60	4.45	1.40	1.44	2.57	3.09
4	5.17	5.76	1.23	1.08	4.20	5.33
5	4.71	5.53	1.42	1.48	3.32	3.74
6	4.07	4.52	1.52	1.17	2.68	3.86
7	3.11	3.53	0.80	0.84	3.89	4.20
8	5.24	5.88	1.29	1.32	4.06	4.45
9	2.76	3.74	1.48	1.54	1.86	2.43

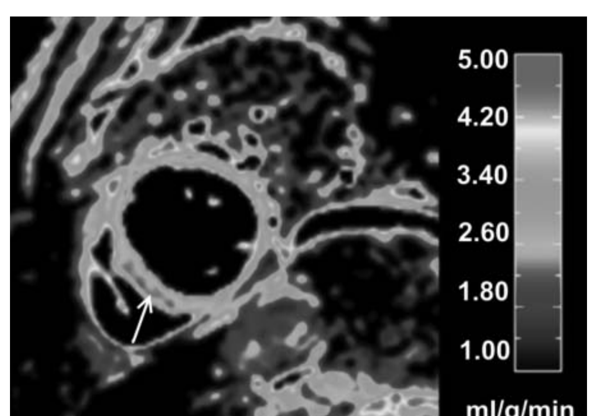

Figure 1

(table 1). Stress MBF was significantly lower in septal regions compared to lateral regions in all patients (septal/lateral ratio=0.86 ±0.07) (table 1, figure 1). Accordingly, the mean stress MBF and mean MPR were significantly lower in the septal regions compared to lateral regions (MBF 3.99±1.03 vs 4.62±0.96 ml/g/min, $p<0.001$; MPR 3.19±0.78 vs 3.71±0.88 ml/g/min, $p<0.01$). However, stress MBF and MPR estimates remained within the published normal range for both septal and lateral regions in all patients (table 1).

Conclusions This study is the first to use quantitative perfusion CMR to evaluate regional differences in MBF in patients with LBBB. The results suggest that although septal perfusion remains normal in LBBB, there is a genuine relative reduction in MBF during stress compared to the lateral wall. This phenomenon may account for the false positive results seen with myocardial perfusion imaging techniques and highlights a potential clinical utility of quantitative perfusion CMR.