Two basic questions usually neglected: the definition of the technical parameters and contrast injection: reply

We thank Lee et al. for their interest in our work.¹ The authors raise the point that the technology itself would be one of the main points of the study and that a more precise description of the technical aspects of 64-slice CT should have been provided. The aim of our study was to report the first clinical experience with the recently introduced 64-slice CT for evaluating patients with suspected coronary artery disease and to assess the diagnostic accuracy of this new technique in comparison with invasive coronary angiography. It was not the purpose to report on technical details and 64-slice CT scanner properties, as this has been already done by Flohr et al. ²

The 64-slice CT scanner used in our study uses a periodic motion of the focal spot, resulting in double sampling in longitudinal z-direction. With a basic detector collimation of 32 × 0.6 mm² and double sampling technique, 64 overlapping 0.6 mm slices per rotation are acquired corresponding to the sampling scheme of a 64 × 0.3 mm² detector. A recent technical study² demonstrates this technique to provide high z-axis resolution especially in cardiac CT scan protocols, which require very low pitch values.

In accordance with the previously described technical principles,² we used the term 'slice collimation' to distinguish this characteristic of the 64-slice CT system from the term 'detector collimation'. We do agree with Lee et al. that the definition of pitch is table feed divided by total detector coverage. Although the focal spot motion increases the amount of samples acquired per projection, the detector coverage per rotation is still determined by the physical width of the used detector rows. Therefore, the physical coverage of the detector equals 19.2 mm based on 32 × 0.6 mm² detector collimation. The pitch used was 0.24 with a rotation time of 0.37 s, resulting in a table speed of 4.6 mm/rotation and 12.4 mm/s. Compared to the previous 16-slice CT scanners, this represents a significant enhancement of the table speed, thus reducing breath-hold times from 16 to 20 s with 16-slice CT scanners to ∼10–12 s with the used 64-slice CT scanner.

The 64-slice CT scanner used has an adaptive array detector design with 40 detector rows. Therefore, the physical coverage per rotation is still determined by the total detector coverage. Although the physical coverage of the detector equals 19.2 mm based on 32 × 0.6 mm² detector collimation. The pitch used was 0.24 with a rotation time of 0.37 s, resulting in a table speed of 4.6 mm/rotation and 12.4 mm/s. Compared to the previous 16-slice CT scanners, this represents a significant enhancement of the table speed, thus reducing breath-hold times from 16 to 20 s with 16-slice CT scanners to ∼10–12 s with the used 64-slice CT scanner.

We thank Lee et al. for their considerations about contrast injection technique. In our study, there was no dependency between the heart rate and the low vessel opacification in distal coronary segments. No segment down to the diameter of 1.5 mm had to be excluded from analysis because of poor image quality. Therefore, we consider our 64-slice CT protocol as highly robust and being diagnostic even in patients with no beta-blockers and high heart rates. It should be always aimed at an optimization of the contrast injection technique, particularly for improved visualization of distal segments in patients with higher heart rates. However, no systematic study verifying the assumption of Lee et al. has been published until now.

References


rate at baseline and was completely ineffecti
tive in those with low heart rate. Although it
remains unclear whether beta-blocker
therapy in coronary patients should be
targeted according to pre-treatment heart
rates, it is important to note that heart
rate is also largely affected by lifestyle-
related factors.

The decreased heart rate of endurance
athletes is well known, 3 and in recent
studies on coronary patients, exercise
therapy that led to meaningful, clinically
beneficial effects was associated with signifi-
cant heart rate reduction. 4 In addition, high
intake of docosahexaenoic n-3 fatty acid, an
cant heart rate reduction. 4 In addition, high
intake of docosahexaenoic n-3 fatty acid, an
essential feature of the Mediterranean diet,
is associated with decreased heart rate. 5
Finally, sympathetic dominance with higher
heart rates may be enhanced by anxiety and depression. Elicitation of the relaxation
response and meditation have been shown
to decrease adrenergic receptor sensitivity
and to increase parasympathetic activity,
thereby leading to reduction of heart rate. 6,7
Therefore, in the clinical approaches to
reduce heart rate in coronary patients, effective non-pharmacological options
should also be considered.

Further studies may also clarify whether
non-pharmacological heart rate reduction may have a comparable protective efficacy as
that of beta-blocking agents in primary and secondary prevention of myocardial infarction.

References

1. Diaz A, Bourassa MG, Guertin MC, Tardif JC.
Long-term prognostic value of resting heart
rate in patients with suspected or proven coronar
ty artery disease. Eur Heart J 2005; 26:
967–974.

2. Palatini P. Heart rate: a strong predictor of mor-
tality in subjects with coronary artery disease.
Eur Heart J 2005; 26:943–945.

3. Carter JB, Banister EW, Blaber AP. Effect of
endurance exercise on autonomic control of

4. Hambrecht R, Walther C, Mobius-Winkler S,
Gielen S, Linke A, Conradi K, Erbs S, Kluge R,
Kendziorra K, Sabri O, Sick P, Schuler G. Percuta-
neous coronary angioplasty compared with exer-
tise training in patients with stable coronary
artery disease: a randomized trial. Circulation

5. Mori TA, Bao DQ, Burke V, Puddye IB, Beilin L.J.
Docosahexaenoic acid but not eicosapentaenoic
acid lowers ambulatory blood pressure and
heart rate in humans. Hypertension 1999; 34:
253–260.

6. Mills PJ, Schneider RH, Hill D, Walton KG,
Wallace RK. Beta-adrenergic receptor sensi-
tivity in subjects practicing transcendental

7. Hoffman JW, Benson H, Arms PA, Stainbrook GL,
Landsberg GL, Young JB, Gill A. Reduced sym-
pathetic nervous system responsivity associated
with the relaxation response. Science 1982;

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Heart rate reduction through lifestyle modification: reply

We thank Drs Michalsen and Dobos for their comments. Resting heart rate is indeed a
strong predictor of mortality in patients with coronary artery disease. 1
Experimental data have demonstrated that a reduction in heart rate can delay the pro-
gression of atherosclerosis in animal models. 2 Atherosclerosis progression has
also been shown to be predicted independ-
ently by minimum heart rate in men after
myocardial infarction. 3 Coronary artery
endothelial cell dysfunction associated with high
heart rates may represent an important
mechanism for increased atherogenesis. 4 In
addition, a mean heart rate >80 b.p.m.
has also been shown to be associated with
a higher risk of atherosclerotic plaque
disruption. 3

Drs Michalsen and Dobos are correct in pointing out that heart rate reduction with beta-blockade is related to the
decline in cardiovascular events after myocardial infarction. We entirely agree
that non-pharmacological options to heart
rate reduction should be evaluated and com-
pared with pharmacological approaches.
However, it is unfortunately often difficult
to obtain significant lifestyle changes (such
as exercise and diet) in large number of
patients in the clinical setting. Because
beta-blockers may have other actions includ-
ing the unmasking of alpha-adrenergic
mediated coronary vasoconstriction and
deleterious changes in lipid and glucose
metabolism, it may also be very interesting
to evaluate the effects of a pure heart
rate-reducing agent that selectively acts on
the sino-atrial node such as the I1 channel
inhibitor ivabradine. 5 The clinical efficacy
of directly targeting heart rate reduction
to decrease morbidity and mortality needs
to be determined in patients with coronary
artery disease.

References

1. Diaz A, Bourassa MG, Guertin MC, Tardif JC.
Long-term prognostic value of resting heart
rate in patients with suspected or proven coronar
ty artery disease. Eur Heart J 2005;
26:967–974.

2. Beere PA, Glagov S, Zarins CK. Retarding
effect of lowered heart rate on coronary

3. Tardif JC, Grégoire J, L’Allier PL, Joyal
M. Chronic heart rate reduction with ivabradine
and prevention of atherosclerosis progression
assessed by intravascular ultrasound. Eur

4. Skantze HB, Kaplan J, Pettersson K, Manuck S,
Blomqvist N, Kyes R, Williams K, Bondjers G.
Psychosocial stress causes endothelial
injury in cynomolgus monkeys via beta1-
adrenoceptor activation. Atherosclerosis 1998;

5. Tardif JC. Clinical efficacy of ivabradine. Heart

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