Once we have the numbers in hand, there is a mysterious tendency to accord them special value. These are the words written by John W. Keyes Jr in his review of $^{18}$F-fluorodeoxyglucose standard uptake value in 1995. In any medical imaging modality, although visual evaluation is always fundamental, quantitative analysis has been developed to support our visual impression. As the quantitative methods progress and gain reliability, they gradually gain the attention of physicians in clinical diagnoses. When the reliability of the number is finally established, it confirms and modifies the visual diagnosis, and it even educates beginners for appropriate diagnosis.

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Several conditions are required for quantitative analysis to be accepted in addition to visual assessment.

(1) **Simplicity and Practicality** The physiological significance should be simple and in accordance with the medical intuition of the physician, even when the underlying theory is complicated.

(2) **Quantification** In visual assessment, the severity of abnormality might be judged based on clinical experiences. Although such visual estimation seems to be subjective, it has been most widely used and practical for well-trained technologists or physicians. However, if the regional information is measured readily by the development of quantitative technology, its usefulness is apparent.

(3) **Reproducibility** The same quantitative results should result from the same original set of examinations, even when the data are processed by different observers or in different institutions. The inter-individual and inter-institutional difference by echocardiography is an important issue at present.

(4) **Integration Into Common Displays** The final result display should be integrated with common display formats in accordance with conventional experiences. Polar map (so called Bull’s-eye display) or 3-dimensional (3D) display formats using appropriate color coding would be commonly used throughout multi-modalities, and it would help users to more easily understand the results.

(5) **Common Normal Database** Normal databases have not been widely used in fields of imaging modalities, except for nuclear cardiology. However, considering that functional parameters are calculated, the quantitative separation of normal and abnormal and grading severity of abnormality would be helpful.

In this issue of the Journal, Kusunose et al studied the clinical utility of the speckle tracking method as a new method of left ventricular functional evaluation. In 2-dimensional (2D) echocardiographic images, speckles appear in the myocardial tissue caused by scattering, reflection and interference of the ultrasound. The myocardial tissue markers can be tracked throughout the cardiac cycle, and the vector of myocardial motion direction can be traced. Using this new technology, longitudinal peak systolic strains were automatically calculated and displayed as a polar map segmentation. The authors then compared the results with visual diagnosis and with gated myocardial perfusion single-photon emission computed tomography (SPECT), which had been validated in clinical routines. Although their gold standard was given by visual diagnosis of well-trained physicians, reasonable concordance was also obtained between echographic longitudinal strain (LS) and nuclear wall thickening (WT). Therefore, the clinical use of speckle tracking seemed to offer appropriate information on wall motion analysis.

From the viewpoint of the threshold for quantification, the authors used the best cut-off value of $-11\% < $LS to identify hypokinetic segments. When compared with gated-SPECT, WT $> 20\%$ in the base and mid-portions, and WT $> 30\%$ in the apical and apex portion were used in their study. The optimal cut-off value of WT is lower than those used in the Japanese Society of Nuclear Medicine Working Group normal databases. Both in echocardiography and nuclear studies, the optimal setting for the grading of asynchrony should be further investigated. However, to obtain a wider range of users, creation of normal databases fitted for a Japanese population would be essential for applying them to multiple-center studies. When the speckle tracking is compared with conventional tissue Doppler methods, movement of the regional tissues is traced better, and is therefore better matched with the regional wall motion analysis. Although a tagging method by magnetic resonance imaging has also been proposed for tracking the motion and torsion, such physiological or pathophysiological movements could be evaluated by the echographic speckle tracking approach. In order to analyze wall motion and torsion, nuclear medicine researchers have also proposed ‘motion-frozen display’. The algorithm for tracking tissue as speckle movement shares common features in...
its development in the motion vectors in gated-SPECT images (Figure). Whether this approach has clinical significance compared with that of conventional visual analysis should be investigated, including the diagnostic role of torsion. Ventricular wall motion is 3D, and the speckle tracking method has also progressed from 2D to 3D area tracking.

How can these new technologies be used effectively? The first application is to assist visual evaluation in patients with coronary artery disease. Although visual evaluation might be used as the first line, if well-integrated results are displayed instantaneously, it can be recorded in a medical chart as an objective result. The second application is to increase diagnostic accuracy using stress protocol. Because echocardiography can be repeatedly used in several stress settings, application of quantification in each step of pharmacological stress (eg, Dobutamine) would be useful to delineate regionally induced ischemia. The third possible application is in the analysis of dyssynchrony in cardiac resynchronization therapy (CRT). Although the disagreement of the timing of wall motion has been evaluated by echocardiography and nuclear methods, to simple best parameter has been proposed. While the PROSPECT study suggested dyssynchrony parameters by tissue Doppler did not provide sufficient predictive values to replace conventional selection criteria, the Speckle Tracking and Resynchronization (STAR) multicenter study used speckle tracking in the response to CRT. The STAR study successfully found that favorable response could be expected when dyssynchrony was detected in radial and transverse strains. Further studies are essential in this challenging field.

While visual evaluation is the routine method, the role of quantification is underestimated. However, when the reliability of quantification is increased, and evidences of the quantification are augmented, the quantification will become helpful and even inevitable in clinical studies. The field of echocardiographic wall motion analysis might be in the beginning of a new era of quantification and functional imaging.

References