

Summed Scores for Semiquantitative Measures in Nuclear Imaging

Nuclear imaging studies performed with gated single-photon emission computed tomography (SPECT) are analyzed not only visually but also by a number of semiquantitative measures performed by the various computer programs used for imaging. Some of the important semiquantitative measures include **summed stress score (SSS)**, **summed rest score (SRS)**, and **summed difference score (SDS)**; also called the summed reversibility score).

17-SEGMENT SPECT MODEL

To understand the semiquantitative scores obtained with SPECT, it is necessary to first become familiar with the coronary arterial model used. Semiquantitative scoring was initially based on a 20-segment model, which was used before the current 17-segment model was introduced and adopted as the standard.¹

The 17-segment model includes 4 segments from the apical slice (actually the distal left ventricle) and 6 each from the mid and basal slices of the short axis, and 1 from the vertical long-axis slice (Figure 1).²

SUMMED STRESS, REST, AND DIFFERENCE SCORES

The SSS, SRS, and SDS incorporate the extent and severity of perfusion defects during stress and rest.³ The **SSS** is a semiquantitative index obtained by adding the individual scores derived from the 17 segments that are analyzed and scored during a stress study. Each segment is scored on a 5-point scale: 0 = normal, 1 = slight reduction of tracer uptake (equivocal), 2 = moderate reduction of uptake (usually implies a significant abnormality), 3 = severe reduction of uptake, and 4 = absence of uptake. An SSS in the normal range indicates a lack of significant abnormality, while higher SSSs reflect greater extent and severity of perfusion defects (Table 1).³

The **SRS** is the summed total of each individual segment score obtained during the rest study. The **SDS**, which indicates the amount of ischemia and the degree of defect reversibility (it is also called the summed reversibility score), is the difference between the SSS and the SRS^{4,5} (Figure 2):

$$SSS - SRS = SDS$$

These scores have been shown to have substantial diagnostic value. In an integrated perfusion/function approach to the detection of coronary artery disease, an SSS greater than 8 or regional wall motion variance greater than 0.114 had a sensitivity of 83%. The presence of any reversibility—ie, SDS greater than 0—increased the sensitivity to 94%.⁶ In a logistic regression model to distinguish ischemic from nonischemic cardiomyopathy, an SSS greater than 8 was the single most significant factor.⁶

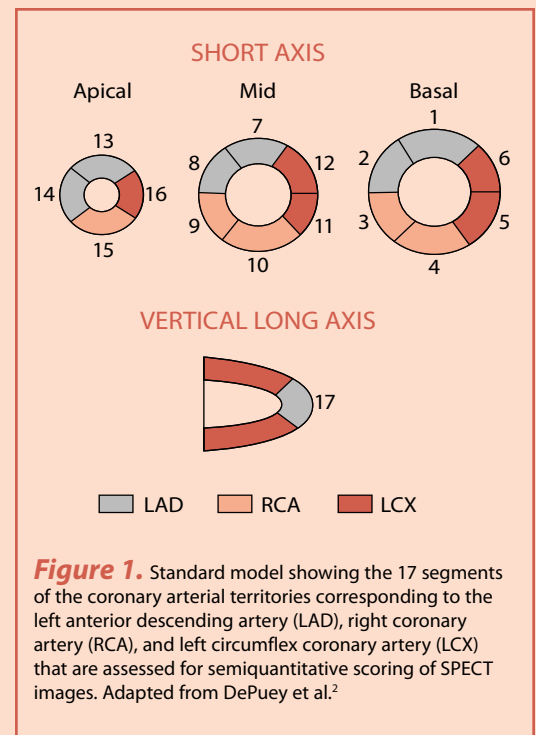


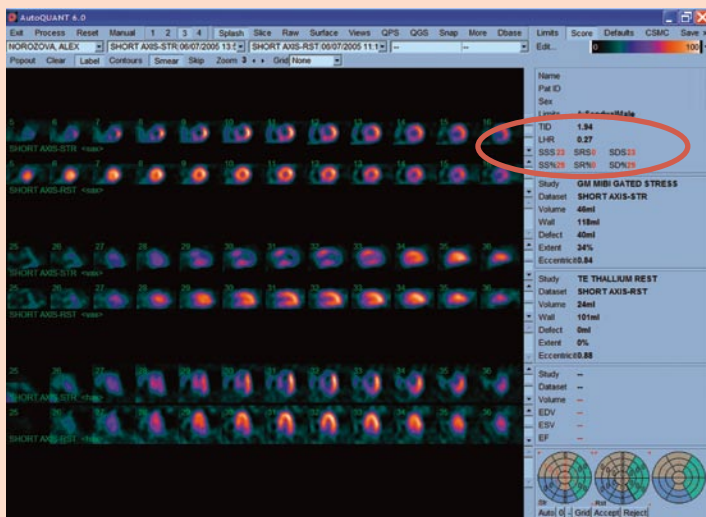
Figure 1. Standard model showing the 17 segments of the coronary arterial territories corresponding to the left anterior descending artery (LAD), right coronary artery (RCA), and left circumflex coronary artery (LCX) that are assessed for semiquantitative scoring of SPECT images. Adapted from DePuey et al.²

Table 1. Summed Stress Score.*

SUMMED STRESS SCORE	INDICATION
<4	Normal
4-8	Mildly abnormal
9-13	Moderately abnormal
>13	Severely abnormal

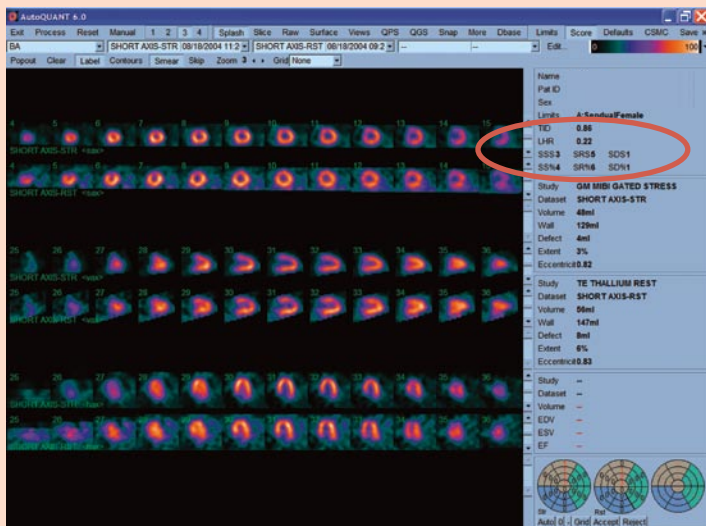
* This table reflects the Cedars-Sinai scoring system. Other centers may use alternative scoring systems with varying cutoffs for “normal” results.

Figure 2. Perfusion SPECT analysis, showing the semiquantitative scores in the upper right corner of the display. The SSS, SRS, and SDS are shown here. The summed motion and summed thickening scores can also be calculated and displayed.



An SDS less than 0 (ie, the SRS is greater than the SSS) rarely occurs in SPECT imaging, and when it does, it likely indicates an artifact in the resting images (Figure 3). A negative SDS score would indicate that perfusion is improved during stress versus rest, and such a result cannot be an accurate reflection of actual myocardial function.

Figure 3. SPECT analysis showing an SDS <0, which likely indicates an artifact in the resting images.



SUMMED MOTION AND THICKENING SCORES

Semiquantitative assessments of left-ventricular (LV) regional wall motion and thickness are also performed during gated SPECT. LV wall motion and thickening can help distinguish reduced tracer concentration due to attenuation from that caused by infarction.⁷ Automated measurements of regional wall motion and thickness abnormalities can provide reasonably accurate identification and grading of regional myocardial dysfunction with gated SPECT.⁸

SUMMARY

SPECT imaging provides a visualization of myocardial perfusion for use in diagnosis and risk stratification of ischemic heart disease. Semiquantitative information obtained during SPECT procedures provides important measurements of disease extent, severity, and reversibility that can be considered along with visual analysis in patient assessment. Semiquantitative scores are useful tools in clinical decision making and have been shown to have independent risk-stratification value.

References

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