Golukhova E. Z.[1], Slivneva I. V.[1], Mamalyga M. L.[1], Alekhin M. N.[2]
[1] Bakulev National Medical Research Center of Cardiovascular Surgery, Moscow, Russia
[2] Central Clinical Hospital of the Administrative Directorate of the President of the Russian Federation, Moscow, Russia

Features of echocardiographic study in patients with COVID-19

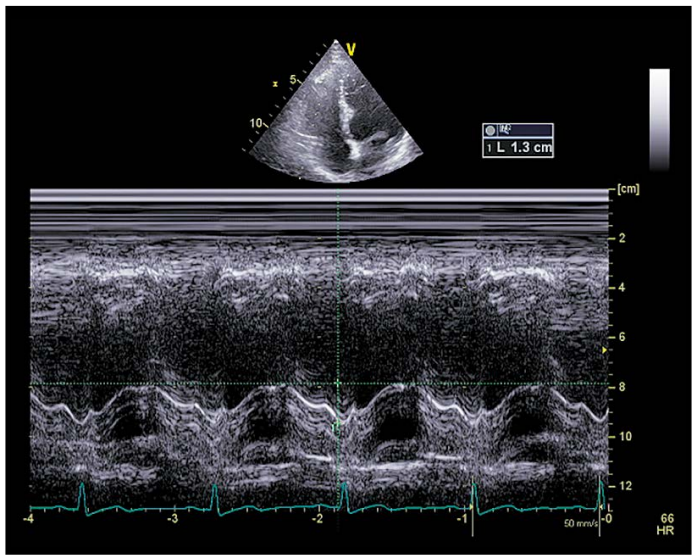
Additional materials.

Advantages and disadvantages of parameters Right Ventricular Assessments in COVID Patients

Abbreviations

RV, right ventricle;
FAC, fractional area change;
EDA, end-diastolic area;
ESA, end-systolic area;
TCOT, tricuspid valve closure-opening time;
IVRT, isovolumetric relaxation time;
IVCT, isovolumetric contraction time;
ET, ejection time;
TR, tricuspid regurgitation;
PW , pulsed-wave Doppler;
Pulsed TDI, pulsed-wave tissue Doppler imaging;
MRI, magnetic resonance imaging.

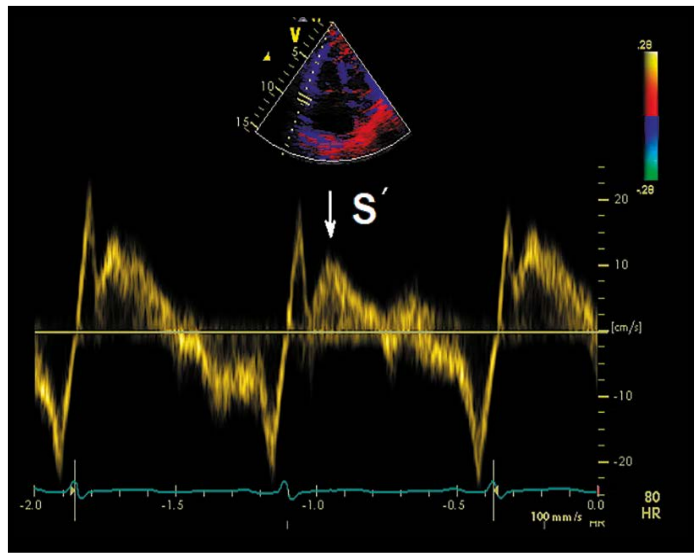
Figure 1. TAPSE, tricuspid annular plane systolic excursion



Advantages: Straightforwardness, reproducibility and availability of the method; less dependent on image quality than FAC.

Disadvantages: RV contractility is translated at the basal level; overestimation of RV function is possible in the presence of asynergy at mid/apical level; dependence on the scanning angle and the exercise conditions; overestimation of indicators is possible in the presence of pronounced TR.

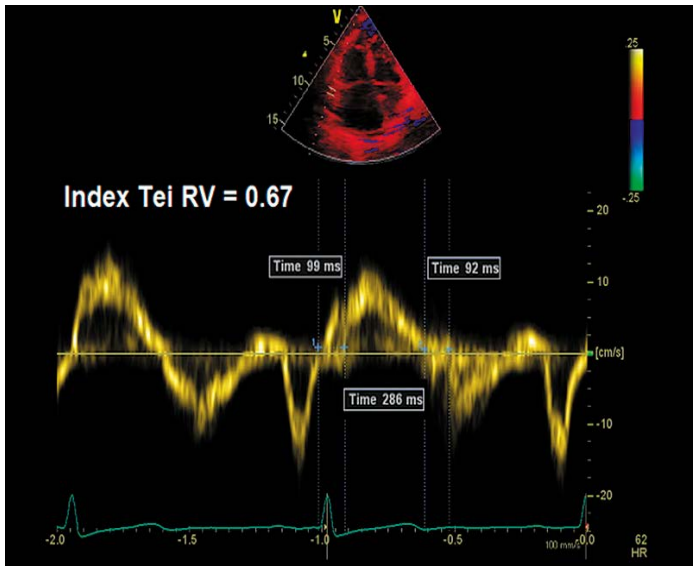
Figure 2. Tricuspid annular systolic velocity (S'), Pulsed TDI



Advantages: Straightforwardness, reproducibility and availability of the method.

Disadvantages: RV contractility is translated at the basal level; overestimation of RV function is possible in the presence of asynergy at middle/apical level; dependence on the scanning angle; overestimation of indicators is possible in the presence of pronounced TR.

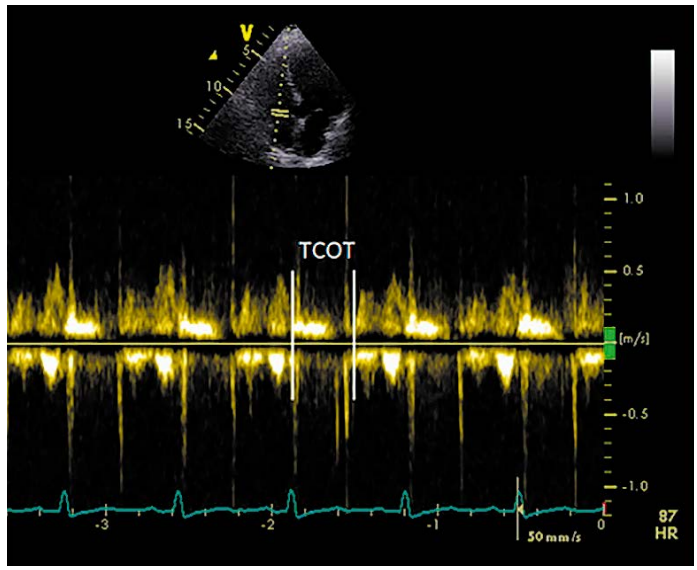
Figure 3. Index Tei (TDI) = (IVRT + IVCT) / ET

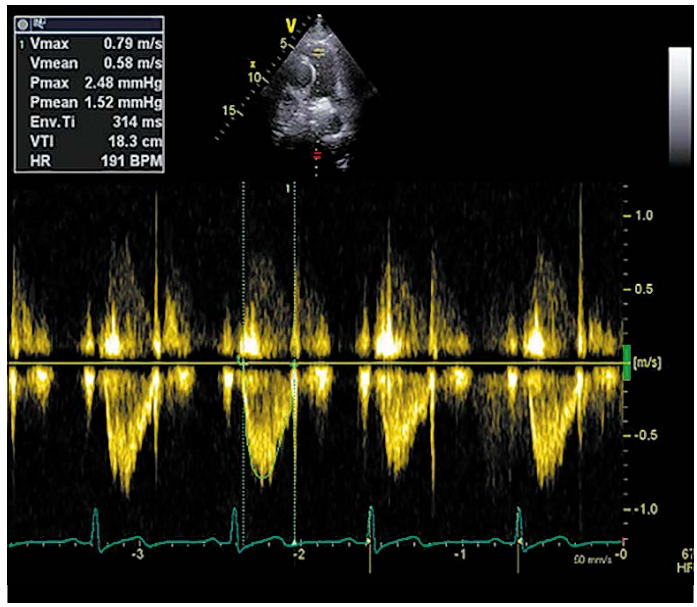


Advantages: Allows simultaneous assessment of RV systolic and diastolic function; less dependent on the exercise conditions, heart rate, and TR than TAPSE or FAC; one cardiac cycle is sufficient for assessment.

Disadvantages: Increased pulmonary pressure leads to pseudonormalization of the indicator (by shortening isovolumic relaxation time (IVRT)); regional estimation; dependence of the angle.

Figure 4. Index Tei (PW) = (TCOT-ET) / ET



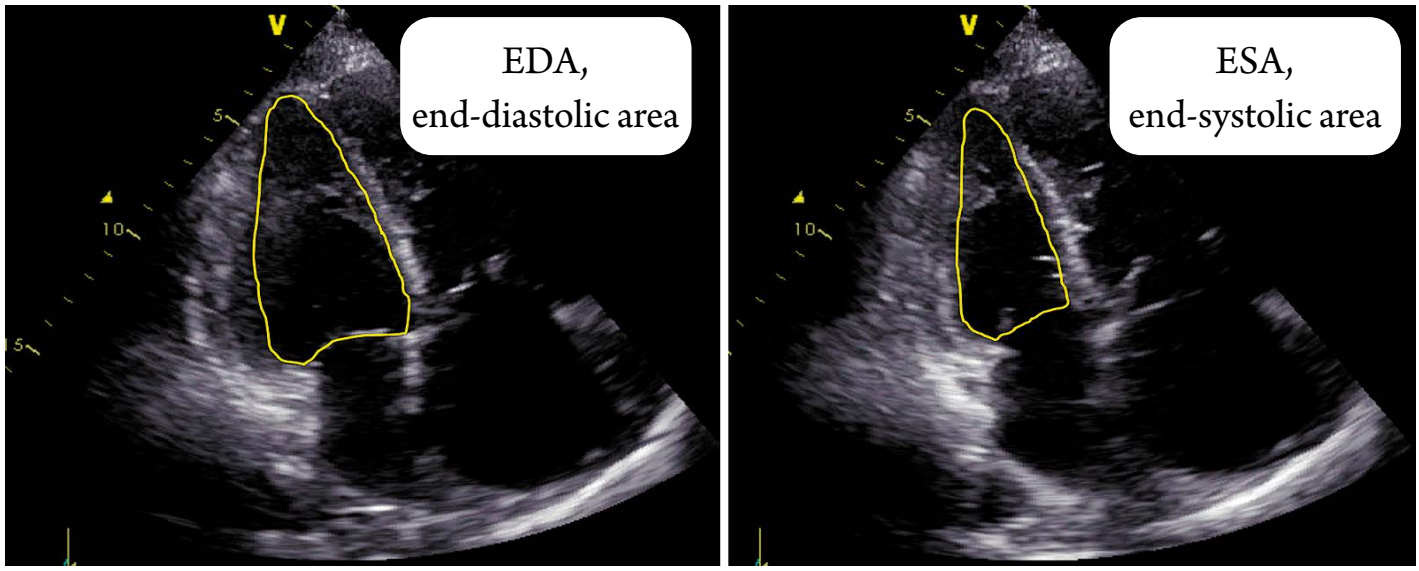


Advantages: less dependent on the exercise conditions, heart rate, and TR than TAPSE or FAC.

Disadvantages: Calculations should be performed in the same R-R intervals, as measurements are made in different cardiac cycles; not applicable in case of elevated right atrial pressure; acoustic interference in the parasternal view in case of impaired aeration of the lung tissue (B-lines).

ISSN 0022-9040. Kardiologiia. 2023;63(5). DOI: 10.18087/cardio.2023.5.n1806

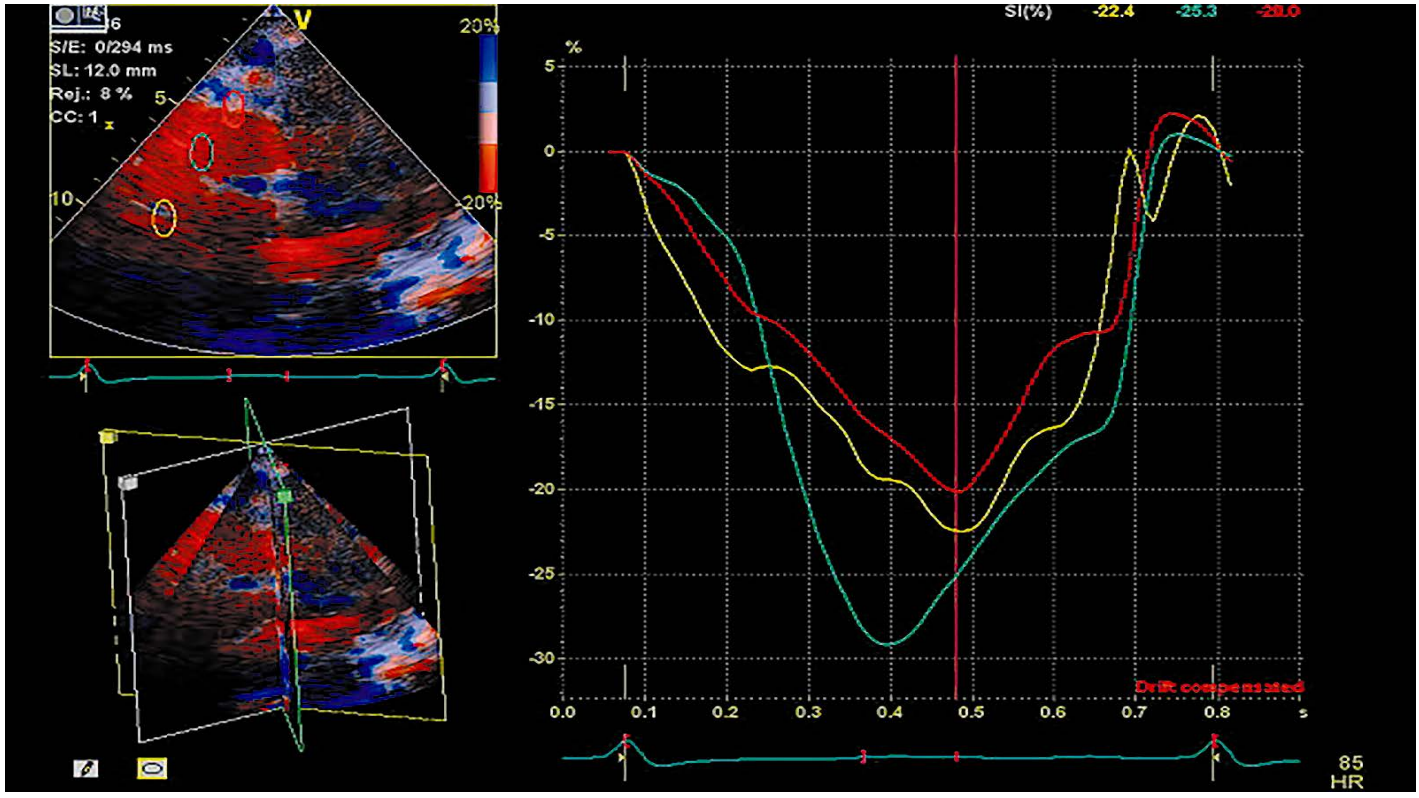
Figure 5. FAC – fractional area change. FAC RV (%) = (EDA-ESA) / EDA x 100



Advantages: Accessibility of the method; includes both longitudinal and radial RV function and can be considered as an as an indirect method to assess RV global systolic function; correlates well with RVEF as assessed by radionuclide angiography or MRI studies and is superior to other standard parameters of 2D echocardiography.

Disadvantages: Difficulty in determining endocardial borders in the presence of severe RV trabecularity or suboptimal imaging quality; single plane estimation of RV areas, the measurement of both planes is influenced by the position of the planes; Dependence on exercise conditions; dependence on image quality, image depth, enhancement parameters; FAC does not take into account the rotation of the RV during systole, which may lead to both underestimation and overestimation of RV contractile function; marked inter-study variability.

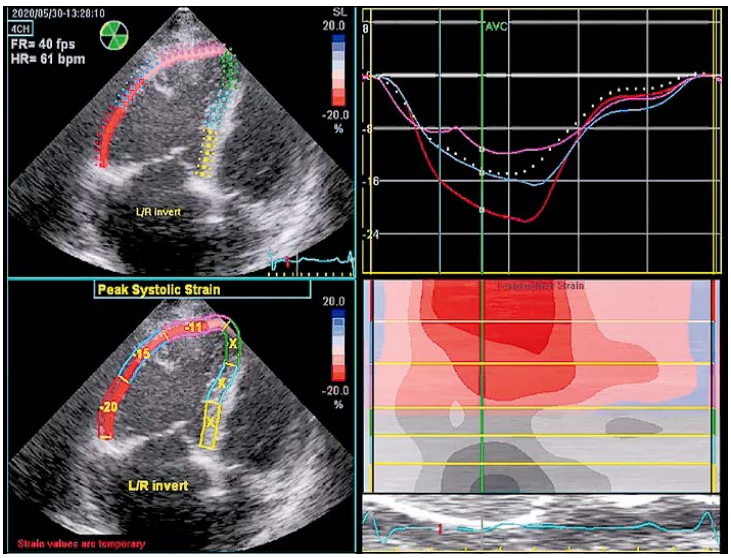
Figure 6. RC Strain and Strain Rate (TDI)



Advantages: Quantitative assessment of regional contractility, less dependence on the motion and rotation of the heart during systole, and the most accurate measurement in TR; the measurement of myocardial function is not affected by the contraction of neighboring segments.

Disadvantages: Dependence on the scanning angle; the thin walls of the RV myocardium with a large excursion of systolic and transverse motion; the high frame rate is required; drift of the strain curve; the dependence on of the heart rate, the exercise conditions, the RV size, and shape; lack of standardization in measurement.

Figure 7. RVFWLS, right ventricular free wall longitudinal strain; RVGLS, right ventricular global longitudinal strain (2D STE)



Advantages: Lack of dependence on scanning angle; quantitative assessment of regional contractility; less dependent on movement and rotation of the heart during systole; most accurate in TR; parameters of RV myocardial strain are predictors of complicated course and unfavorable outcome in various pathologies; calculation of mean strain of all segments within the ultrasound slice.

Disadvantages: Highly dependent on image quality, artifacts, and enhancement parameters; uses 4-chamber view with assessment of RV longitudinal strain only; possible loss of tracking speckles with excessive RV wall motion; inter-study variability; lack of measurement standardization; incorrect positioning of landmarks or width of area of interest (due to thin RV free wall) will bias results; measurement of myocardial function is affected by contraction of adjacent segments.

ISSN 0022-9040. Kardiologiia. 2023;63(5). DOI: 10.18087/cardio.2023.5.n1806