Validation of a new intuitive software for automatic heart function analysis. An intraobserver variability study.

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Funding Acknowledgements: Type of funding sources: Public hospital(s). Main funding source(s): University Hospital of Padua

Background/Introduction: In recent years there has been a growing interest in artificial intelligence (AI) applications in the echocardiography field. This is in order to simplify, reduce time and amplify the use of advanced analyses in the echo lab.

Purpose: to compare results of the fully automated analysis and manual tracing analysis using a new intuitive software.

Methods: 28 consecutive previously healthy patients less than 18 years old who were screened at our Center for cardiac evaluation within 6 months after an asymptomatic or paucisymptomatic COVID19 infection were enrolled. All they were in sinus rhythm. Standard transthoracic echocardiography (TTE) was performed for each patient using Canon Aplio i900, software 2D Wall Motion Tracking. Optimized apical 4-, 3- and 2- chamber views, mitral valve inflow pattern and LVOT Doppler interrogation were collected. Off-line data analysis of each examination was performed by both fully automated analysis (AI) and pediatric cardiologists with experience in echocardiography i.e. by manual tracing, evaluation and adjustment of the track by the operator (Echocardiographers). Operators were blinded to the AI analysis. To measure intraobserver variability, evaluations of 16 patients datasets were performed twice by both operators and AI.

Results: Patients' demographic data were: age 9,8+/-4,7 years; males 22 (78%); height 134,3+/- 34,9 cm; weight 41,8+/-28,7 kg; BSA 1,2+/-0,4 mq, HR 85+/-15/min.

The time taken for off-line analysis by AI and echocardiographers was 4-5 and 13-20 minutes, respectively.

Reproducibility of echocardiographers' analysis was found to be excellent for left ventricle assessment (IC from 0,88 to 0,98); moderate for LVOT mean gradient (IC 0,73), RV end diastolic area (IC 0,69) and right atrial strain (IC 0,59); poor for deceleration time (IC 0,5), left ventricle strain (IC 0,49), RV FAC and strain (IC from 0,27 to 0,45).

Conversely, reproducibility of the AI analysis was found to be excellent for any parameter (ICC from 0,87 to 0,99) (Table 1).

About the mitralic valve inflow pattern assessment, despite the excellent reproducibility of AI analysis, the margin of error was found to be high. Particularly, a systematic error was observed with a tendency of the AI to overestimate deceleration time (DT-AI 176,6 ± 63,8 vs DT-Ecocardiographers 150,4 ± 24,3).

Conclusion(s): Fully automated analysis is technically simple, less time consuming and highly reproducible. AI analysis of the mitralic inflow pattern should be optimized, having found a systematic error in the calculation of deceleration time. Reproducibility is the strong point of AI. This reduces the variability of manual measurements between different sonographers and at different times.

Abstract Table 1. Echocardiographic measurements

Table 1. Echocardiographic measurements performed by both AI and echocardiographers (mean±SD). Intraobserver variability calculated with Intraclass Correlation Coefficient (ICC).

	Echocardiographers		AI	
	Mean ± SD	ICC	Mean ± SD	ICC
BP LVEDVi	56,8±15,5	0,98	55,1±10,0	0,95
BP LV-FE	58,3±5,5	0,88	58,3±7,6	0,99
LV-GLS	-20,9±2,3	0,91	-20,0±3,3	0,92
E/A ratio	1,77±0,41	0,89	1,87±0,53	0,99
DT	150,4±24,3	0,50	176,6±63,8	0,97
LVOT mean gradient	3,2±1,1	0,73	3,4±1,3	0,93
RV-EDAi	11,6±2,7	0,69	11,3±1,9	0,99
RV-FAC	40,7±4,1	0,27	40,2±4,4	0,88
RV-GLS FW	-27,9±3,8	0,45	-28,1±3,4	0,96
RV-GLS Avg	-24,4±3,0	0,39	-23,9±2,7	0,92
LASr 4Ch	45,7±10,9	0,49	45,3±11,8	0,91
RASr	45,4±12,5	0,59	44,4±12,9	0,87

BP LVEDVi = biplane left ventricle end diastolic volume indexed; BP LV-EF = biplane left ventricle ejection fraction; LV-GLS = left ventricle global longitudinal strain; E/A ratio = E wave velocity/A wave velocity ratio; DT = deceleration time; LVOT mean gradient = left ventricle outflow tract; RV-EDAi = right ventricle end diastolic area indexed; RV-FAC = right ventricle fractional area change; RV-GLS-FW = right ventricle free wall strain; RV-GLS Avg = right ventricle average strain; LASr 4Ch = left atrial reservoir strain in 4 chamber view; RASr = right atrial reservoir strain.