Cardiac Ultrasound Clinical Case Study

Artificial Intelligence: How useful is Auto EF with Aplio i-series?

Auto EF is frequently used to assess LV function with Aplio i-series systems

Background

The most widely accepted and used measure of LV systolic function has been ejection fraction (EF), defined as the fraction of end diastolic volume ejected with each LV contraction. This unique parameter in cardiology, has served as a selection criterion for almost all landmark therapeutic trials of heart failure, and is well integrated in the clinical guidelines [1].

The American Society of Echocardiography (ASE) and the European Association of Cardiovascular Imaging (EACVI) recommend assessment of LVEF by 2D using the modified Simpson's biplane method of disks summation technique, acquiring LV volumes from apical 4- and 2- chamber views, or when practical by 3D full volume acquisition [2]. The additional time and variability in manual 2D tracing however, has led to the increasing use of visual assessment or "eyeballing" EF in busy departments and practices [3].

With Canon Medical's Aplio i-series systems, the inconsistencies in manual tracing and subjectivity in visual assessment can be overcome with the use of image processing algorithms that allow fully automated measurement of EF, known as Auto EF.

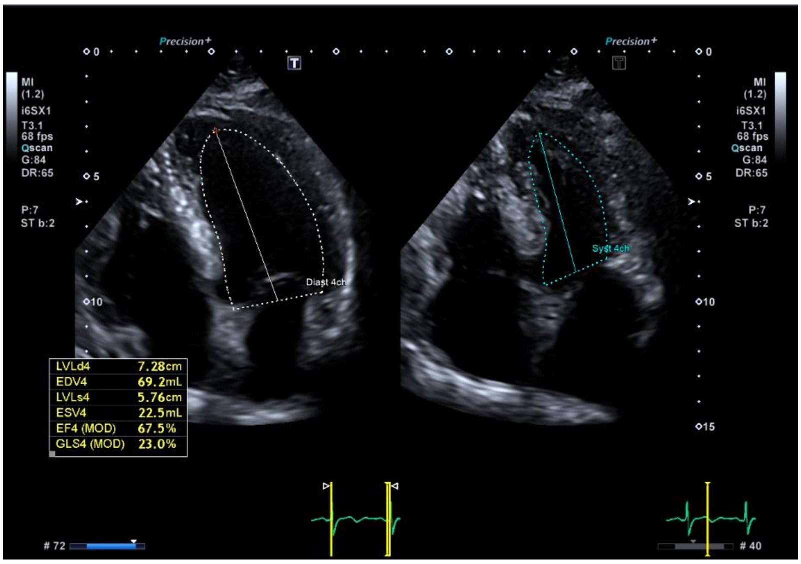

Fig 1: Auto EF in the apical 4 chamber view easily assesses LV function with minimal adjustment required

Fully automated measurement of EF can be performed within seconds, is technically feasible, and is comparable with manual 2D tracing [4,5]. Further Auto EF is more reproducible than visual assessment by the expert reader [5]. Automated imaging analysis also provides information beyond LV volumes and EF, with global longitudinal strain (GLS) included, which unlike conventional methods of EF and GLS assessment has no variability [4].

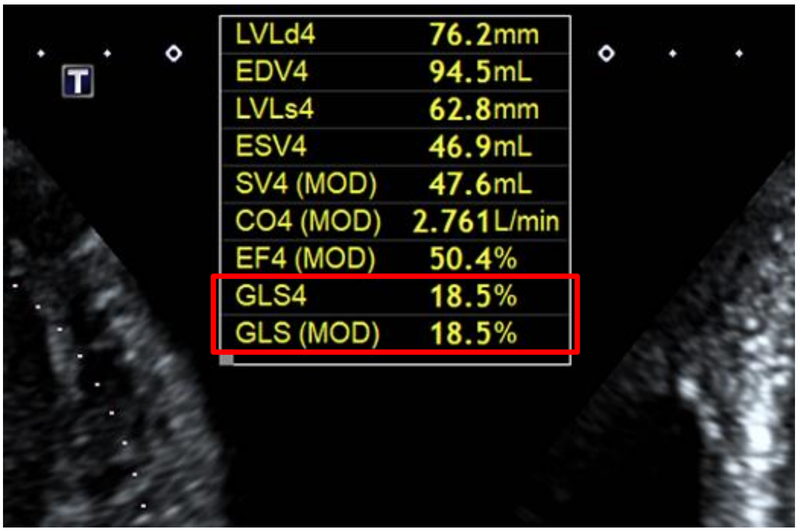

Fig 2: Global longitudinal strain (GLS) included in the Auto EF analysis in the apical 4 chamber view

The GLS result from the Auto EF measurement is calculated according to variations in the length of the endocardial border trace lines [Fig 3. (a)], with the mean GLS calculated from the GLS values of both the apical 4- and 2- chamber views [6]. In 2D Wall Motion Tracking strain, GLS is calculated by dividing the line of the endocardium into equal lengths and strain calculated based on the total variations in length at each point [Fig 3. (b)] [6].

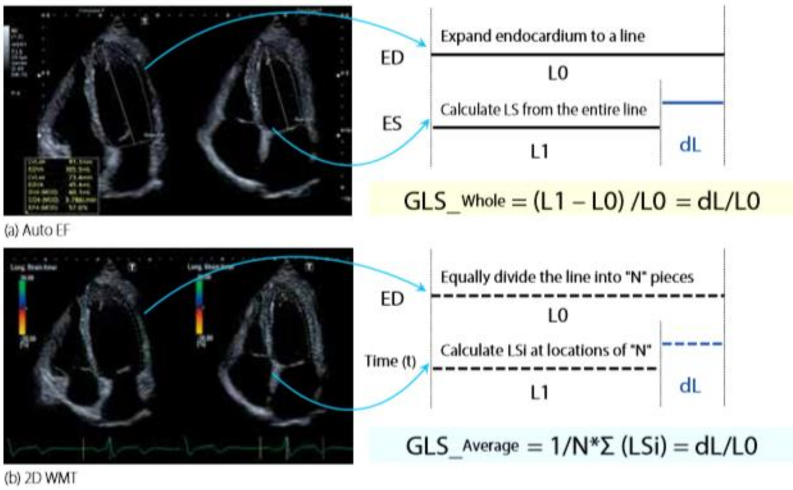

Fig 3: Calculation of global longitudinal strain (GLS) in Auto EF and 2D Wall Motion Tracking of the apical 4 chamber view [6]

In patients with LV dysfunction, LVEF and GLS have a linear relationship, with a LV ejection fraction of 35% corresponding to a GLS of -11 or -12 [7]. In contrast, LVEF and GLS have a curvilinear relationship in patients with normal LV ejection fraction [7]. The ability of GLS to detect subclinical myocardial dysfunction is therefore likely greatest for patients with normal ejection fraction. The advantage of including GLS in addition to LVEF is its sensitivity to detect early subclinical disease before LV ejection fraction declines [8].

Conclusion

Assessment of LVEF and GLS may be useful to guide clinical management, but manual measurements are often time consuming and variable leading to visual assessment. Canon Medical's Aplio i-series systems offer fully automated measurement of EF with GLS that could standardize these measurements to facilitate better patient care.

References

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