

## #ASEchoJC Twitter Chat

Tuesday, October 12, 2021 – 8 PM ET

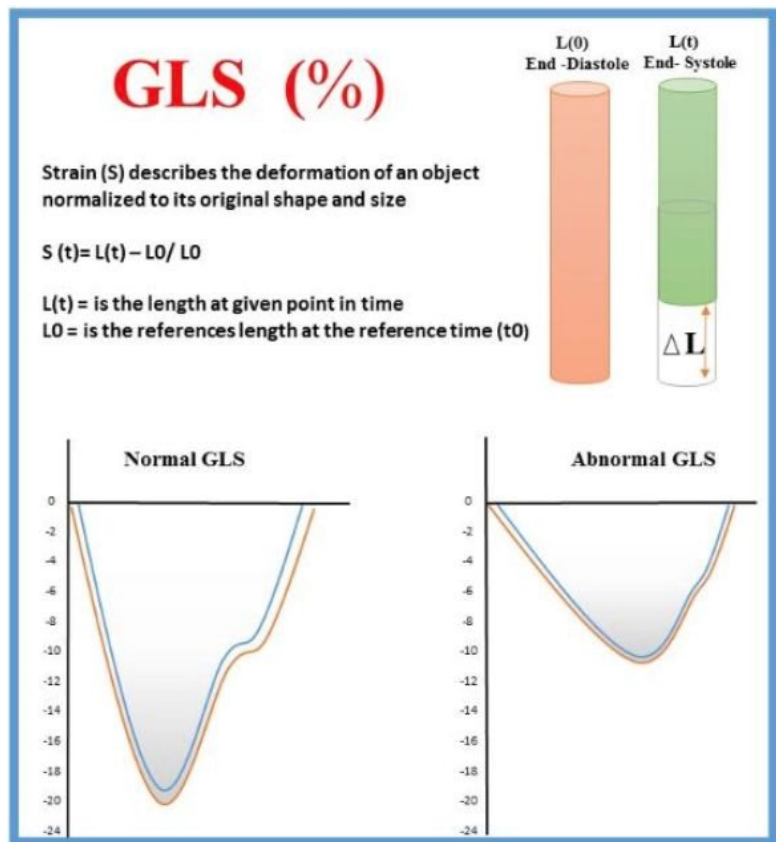
- **Strain-Guided Management of Potentially Cardiotoxic Cancer Therapy** (JACC, February 2021)
- **Left Ventricular Global Strain Analysis by Two-Dimensional Speckle-Tracking Echocardiography: The Learning Curve** (JASE, November 2017)
- **Echocardiography Core Laboratory Reproducibility of Cardiac Safety Assessments in Cardio-Oncology** (JASE, February 2018)

Moderators: **Ritu Thamman, MD, FASE (@iamritu)**, and Cardio-Oncology SIG Leaders, **Marielle Scherrer-Crosbie, MD, PhD, FASE – Chair (@mariellesc1)**; **Henry Cheng, MD – Co-Chair (@oslermarine)**; **Juan Carlos Plana, MD, FASE (@juancplana)**; **Alexandra Gardner, RDCS, FASE (@alexFASE27)**; **Victor Ferrari, MD, FASE (@VicFerrariMD)**; **Juan Lopez-Mattei, MD, FASE (@onco\_cardiology)**; **Jiwon Kim, MD, FASE (@JiwonKimMD)**; and **Amber Taylor, BS, ACS, RCS, RVS (@ambergtaylorgm1)**

Read the Tweetorial before getting started:

<https://twitter.com/iamritu/status/1447731056833187844?s=20>

**Introduction and Welcome:** Welcome to tonight's #ASEchoJC with our #CardioOnc #SIG: @VicFerrariMD @JiwonKimMD @ambergtaylorgm1 @mariellesc1 @juancplana @onco\_cardiology @alexFASE27 @oslermarine with @EGarciaSayan @NadeenFaza @ash71us @rajdoc2005 @DocStrom All welcome!!



### Q1: What was the motivation to use GLS to improve patient care?

#### A1 Notable Responses:

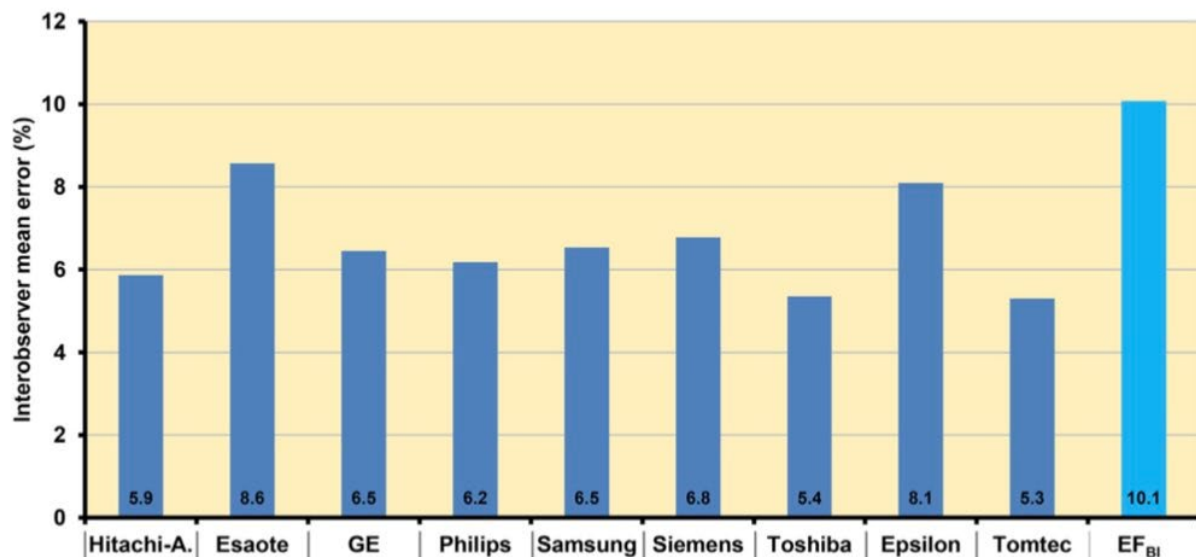
**@iamritu:** Needed a way to predict LV systolic function decline before LV EF drop occurred (potentially irreversible damage)

**@ambergtaylorgm1:** Striving to improve patient care! Trying to prevent irreversible EF drop.

**@boegel\_kelly:** GLS has been a great addition to the echo protocol. Definitely can help define or present a new or underlying pathology and help guide patient treatment management

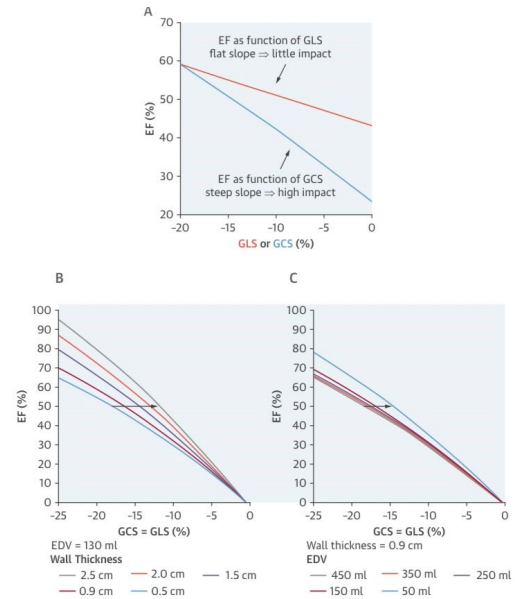
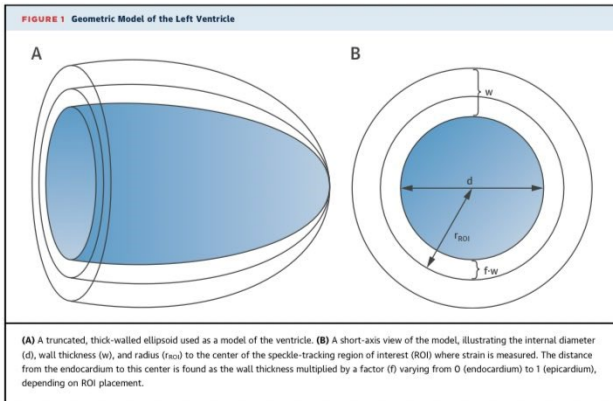
**@onco\_cardiology:** High variability of LVEF plays a big role in why the need of more reproducible techniques like GLS. Monitoring for cardiotoxicity is an important part of cancer care!!

**@iamritu:** well said by @onco\_cardiology! In fact in a @JournalASEcho paper on strain intervendor variability the most variable parameter was found to be EF!!



**@VicFerrari:** A (less) load-dependent and quantifiable measure of LV function over time is valuable for patient management and predicting LVEF decline before symptoms or larger measurable LVEF changes is crucial...





**@oslermarine:** GLS serves the need for reliable and reproducible early detection of LV dysfunction

**@JiwonKimMD:** GLS has been shown to be a more sensitive and reproducible measure of myocardial dysfunction compared to EF.

**@CardiacZhao:** Frequently used to assess cardiac function (esp subclinical cardiotoxicity) in pts under cancer treatment

**@mariellesc1:** The LVEF did not detect cardiotoxicity soon enough – strain is very sensitive. Another potential advantage of strain is that longitudinal strain reflects subendocardial fiber layer that may be affected sooner than mid myocardial (EF)

**Q2: What is the normal range of GLS (global longitudinal strain)**

**A2 Notable Responses:**

**@mariellesc1:** There are many vendors and some variability- it is often accepted that  $<-16\%$  is probably abnormal.  $-16 < \text{strain} < -20$  is a grey zone, depends one age,  $>-20$  OK!

**@mariellesc1:** in our lab, we often retrace with vendor independent when not sure...a difference of 15% between 2 echoes is considered abnormal but you need great reproducibility for that...

**@onco\_cardiology:** Definitely. Vendor dependent. But for most a GLS of  $-16$  or less -be is abnormal

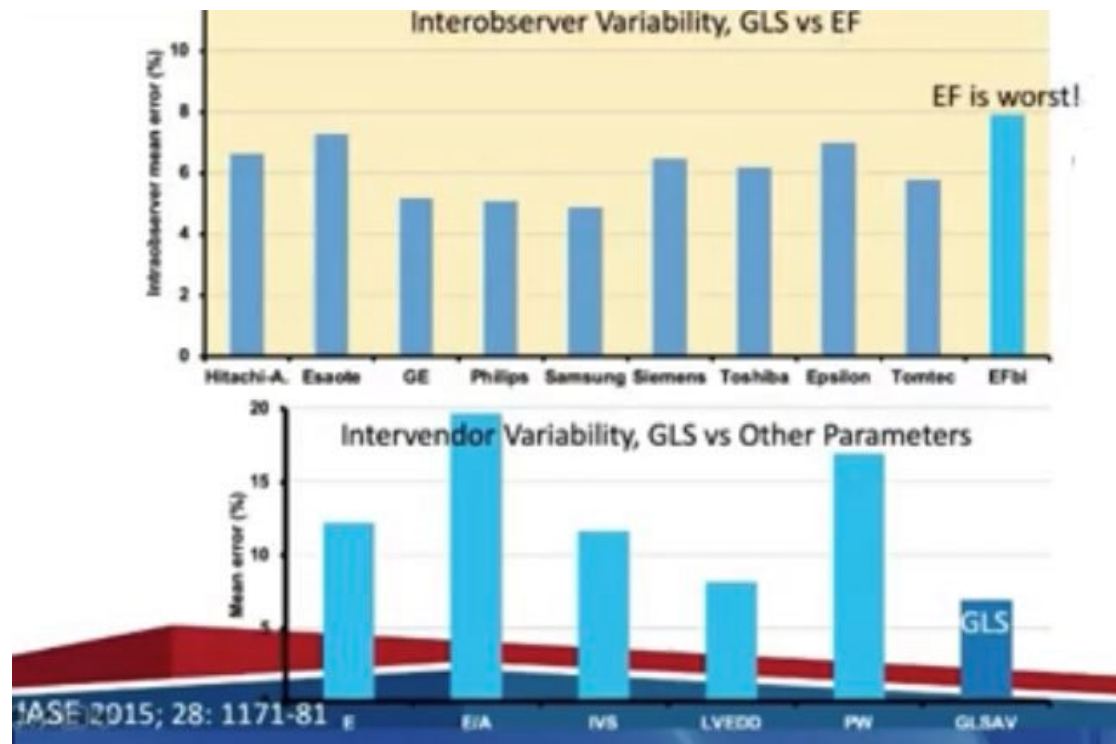
**@ambergtylorgm1:** Equipment vendors vary in ranges, however  $<-18\%$  is widely accepted cutoff

**@Siwa23288585:** Previously various depending on the model from 21ASE

**Supplemental Table 6** Normal LV strain values from meta-analysis and individual recent publications using specific vendors' equipment and software

vendor	Software	n	Mean	SD	LLN	Reference from list below
Varying	Meta-analysis	2597	-19.7%		NA	1
GE	EchoPAC BT 12	247	-21.5%	2.0%	-18%	2
	EchoPAC BT 12	207	-21.2%	1.6%	-18%	3
	EchoPAC BT 12	131	-21.2%	2.4%	-17%	4
	EchoPAC 110.1.3	333	-21.3%	2.1%	-17%	5
Philips	QLAB 7.1	330	-18.9%	2.5%	-14%	5
Toshiba	Ultra Extend	337	-19.9%	2.4%	-15%	5
Siemens	VVi 1.0	116	-19.8%	4.6%	-11%	6
	VVi 1.0	82	-17.3%	2.3%	-13%	7
Esaote	Mylab 50	30	-19.5%	3.1%	-13%	8

@iamritu: Achilles heel has been Intervendor & interobserver variability <https://bit.ly/3mGzUSU> But this @JournalASEcho shows EF is more variable than GLS & current software algorithms are within 2% of each other



@DavidWienerMD: A joint document on strain standardization among vendors was published in 2015 by @ASE360 and the EACVI @escardio to address intervender variability: [https://onlinejase.com/article/S0894-7317\(14\)00831-1/fulltext](https://onlinejase.com/article/S0894-7317(14)00831-1/fulltext). A #guideline update on future directions in strain is in progress.

@iamritu: @tom\_marwick defined the cutoffs in 2009

<https://jacc.org/doi/abs/10.1016/j.jcmg.2007.12.007> which have become more refined as the technology has advanced!

## Myocardial Strain Measurement With 2-Dimensional Speckle- Tracking Echocardiography: Definition of Normal Range

### Brief Report

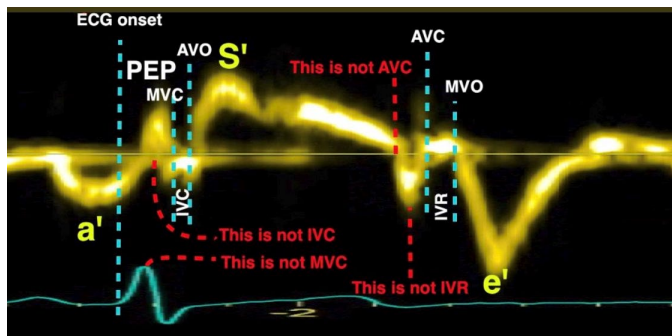
Thomas H. Marwick, Rodolphe L. Leano,  
Joseph Brown, Jing-Ping Sun,  
Rainer Hoffmann, Peter Lysyansky,  
Michael Becker, and James D. Thomas

J Am Coll Cardiol Img. 2009 Jan, 2 (1) 80–84

**Q3: What are best practices in obtaining GLS and reducing variability?**

### A3 Notable Responses:

@iamritu: Remember to get the exact AVC timing correct @strain\_rate, avoid LVOT & LA in ROI, use wide ROI to encompass at least 85% of the myocardium, avoid foreshortening LV( length will determine your GLS) ,image quality is key to best tracing/ROI'



Asbjørn Støylen · 8/31/21 ...

Apart from the physiological implications, what are the consequences of this study  
[onlinelibrary.wiley.com/doi...](https://onlinelibrary.wiley.com/doi/10.1016/j.jcmg.2007.12.007)

## Global Longitudinal Peak Systolic Strain



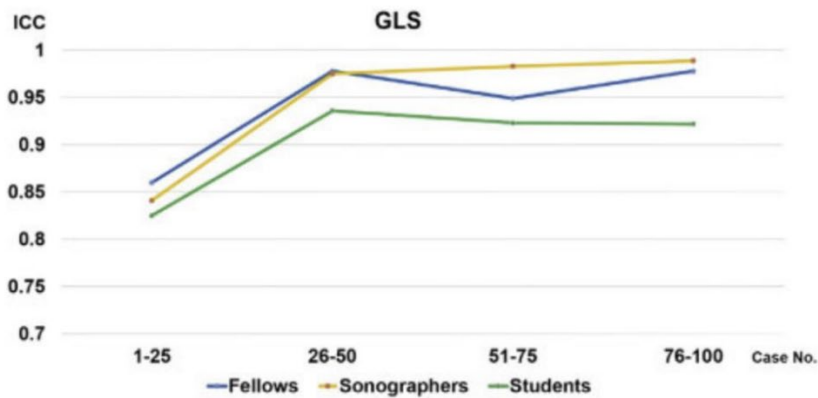
1. Timing of Aortic Valve Closure
2. Avoid LVOT
3. Avoid the Atrium
4. ROI to Wide
5. Foreshortened Images

**@boegel\_kelly:** Image optimization is so important and making sure your frame rates are between 40-80 fps with similar HRs. Can not obtain good reproducible strain without good quality 2D image

**@oslermarine:** Agree, also skilled echo techs are very important to produce quality images for strain analysis.

**@onco\_cardiology:** There is a learning curve, but is achievable to get high quality strain for docs and sonographers a like, as shown in this great article [https://asecho.org/wp-content/uploads/2021/10/Left-Ventricular-Global-Strain-Analysis-by-Two-Dimensional-Speckle-Tracking-Echocardiography -The-Learning-Curve-PIIS0894731717304698.pdf](https://asecho.org/wp-content/uploads/2021/10/Left-Ventricular-Global-Strain-Analysis-by-Two-Dimensional-Speckle-Tracking-Echocardiography-The-Learning-Curve-PIIS0894731717304698.pdf)





**Figure 1** GLS Learning curve. ICC of each group compared with expert over consecutive quartiles of 25 cases.

ischemic heart disease, 26 patients performed echocardiography for chest complaint, 20 patients had coronary heart disease, 11 patients had valvular heart disease, eight patients had cardiomyopathy, and two patients had pericarditis.

**GC**  
two  
95%  
10.1  
mer  
LO,  
15%  
from  
ative  
duc  
stuc  
to 1

**GR**  
**Lea**  
cant  
con  
incc  
.

**@JiwonKimMD:** In this study, a minimum of 50 studies for training was required for those with background in echocardiography to obtain competency in GLS analysis

**@ambergtaylorgm1:** Use consistent system throughout therapy. Make sure to choose a 4 c, 3 c, and 2 c with similar heart rates. Try to select index beats.

**@ash71us:** Does anyone still perform offline strain measurements routinely or let the sonographers perform and agree/disagree?

**@boegel\_kelly:** Sonographer here! I perform Strain Imaging on a daily basis and feel completely confident with my acquisition

**@ash71us:** Also, what's the practice at your institution for reporting in terms of the machine used for strain? Do you perform it using different machine platforms when the patient presents for follow up studies or do you stick with the same machine type - eg IE33 or epic?

**@boegel\_kelly:** You should stick to the same machine type if possible

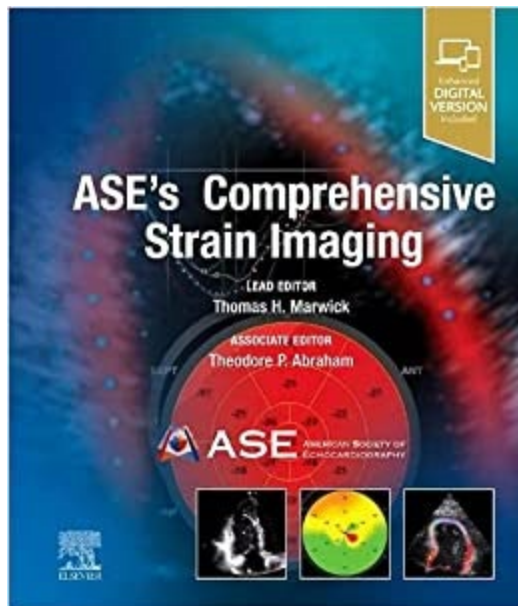
**@JiwonKimMD:** We always try to use the same vendor software for follow up studies

**@onco\_cardiology:** Just sharing an old thread where I talk about how to obtain it:

[https://twitter.com/onco\\_cardiology/status/1015099780303933440?s=20](https://twitter.com/onco_cardiology/status/1015099780303933440?s=20)

**@juancplana:** Do not include the pericardium, the LVOT or the mitral valve annulus

**@DavidWienerMD:** Can't resist putting in a plug for the authoritative textbook on strain imaging published by @ase360 this year. Authored by Marwick and Abraham, it is available from the ASE Learning Hub at <https://aselearninghub.org/topclass/topclass.do?expand-OfferingDetails-OfferingId=4382472>



**Q4: What training is needed to optimize GLS acquisition?**

**A4 Notable Responses:**

**@iamritu:** Is there a minimum number of #GLS acquisitions needed to be proficient? What's the learning curve?

**@BravuraGeorgio:** Dedication

**@AlexFASE27:** Our lab does frequent QI to help review to improve sonographers accountability.

**Q5: Can we improve the reproducibility of echocardiographic measurements in cardiotoxicity monitoring?**

**A5 Notable Responses:**

**@iamritu:** This is such an important question/ point! Now a days there is only 2% variability b/w vendor software algorithms for GLS but still we like to use the same vendor/machine for comparisons

**@onco\_cardiology:** We can. It takes a lot of commitment and ideally in collaboration with other center to calibrate measurements if part of a clinical trial. This paper outlines what is needed to be successful at it. Adherence to quantitative guidelines, QA, calibration <https://asecho.org/wp->



<content/uploads/2021/10/Echocardiography-Core-Laboratory-Reproducibility-of-Cardiac-Safety-Assessments-in-Cardio-Oncology-PIIS089473171730826X.pdf>

- @VicFerrariMD:**
1. Standardization of views in lab
  2. Comparable heart rates
  3. Best endocardial definition (Garbage in = Garbage out!)
  4. Frequent QI/QA
  5. Bidirectional feedback in lab
  6. Same manufacturer for same patient
  7. Avoid overzooming - algorithm needs landmark
  8. Practice!

**@ambergtyalorgm1:** Reproducibility can be improved with as much consistency throughout therapy as possible!

**@juancplana:** An important part of reproducibility is to determine how adequate the tracking is before you analyze the strain

**@iamritu:** How do you determine your tracking is adequate?

**@juancplana:** You would like to see your area of interest following the contraction of the segment (not doing its own thing)

**@JiwonKimMD:** Also important to try to use same vendor software for serial studies to improve reproducibility. We report the value and vendor used

**@mariellesc1:** Although this is suboptimal, we sometimes report the apical 4 chamber if the algorithm is not tracking the other chambers- at least it gives an idea of the strain- what do others do?

**@juancplana:** I think it's fair as long as you mention the lack of tracking in other views. It puts you in the ball park!

**Q6: What is the evidence to use strain in cancer patients?**

**A6 Notable Responses:**

**@iamritu:** Lots of data ... here's a paper from @mariellesc1 Showing less cardiac events w pre chemotherapy #GLS

## Baseline GLS & CV Outcomes in Hematologic Malignancies



- \* N = 450 patients with Leukemia or Lymphoma
- \* Treated with anthracycline
- \* Follow-up 4-5 years
- \* 6% cardiac events (CE = cardiac death/symptomatic HF)
- \* DM, HTN were primary risk factors
- \* Pre-chemo GLS was independently associated with CE ( $P < 0.0001$ )

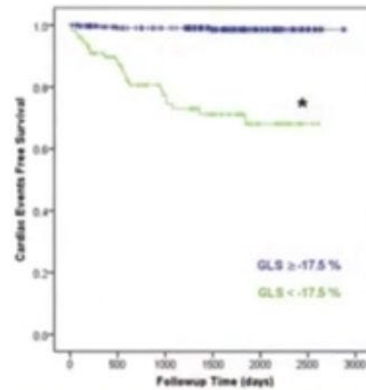


Figure 2 CE-free survival according to GLS. Kaplan-Meier curves depicting event-free survival in patients with GLS above or below the absolute value of  $-17.5\%$ . Pts, Patients. \* $P < .0001$ .

Ali et al. J Am Soc Echocardiogr 2016; 29: 522-27.

## Baseline GLS & CV Outcomes in Hematologic Malignancies



- \* N = 450 patients with Leukemia or Lymphoma
- \* Treated with anthracycline
- \* Follow-up 4-5 years
- \* 6% cardiac events (CE = cardiac death/symptomatic HF)
- \* DM, HTN were primary risk factors
- \* Pre-chemo GLS was independently associated with CE ( $P < 0.0001$ )

Cut-off Baseline GLS  $< -17.5\%$  was associated with 6x increase in cardiac events.

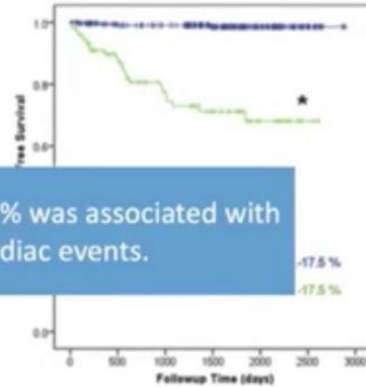


Figure 2 CE-free survival according to GLS. Kaplan-Meier curves depicting event-free survival in patients with GLS above or below the absolute value of  $-17.5\%$ . Pts, Patients. \* $P < .0001$ .

Ali et al. J Am Soc Echocardiogr 2016; 29: 522-27.

@mariellesc1: Strain at baseline and post-anthracyclines is predictive of subsequent LV dysfunction, strain at baseline predicts symptomatic heart failure in patients treated with anthracyclines.

@mariellesc1: Also, strain can triage patients treated with anthracyclines who have LVEF at the lower limits of normal: <https://pubmed.ncbi.nlm.nih.gov/25925220/>

**@onco\_cardiology:** Good question. This is my take on the #SUCCOUR trial. <https://www.acc.org/latest-in-cardiology/articles/2021/04/16/13/09/the-succour-trial> In summary, #SUCCOUR was the first RCT to assess whether strain guided cardiotoxicity monitoring was superior to LVEF monitoring. Unfortunately it didn't meet its 1ry endpoint and stronger endpoints.

**@oslermarine:** I think a larger sample size would have helped.

**@EGarciaSayan:** @onco\_cardiology take on #SUCCOUR trial, first RCT to assess a strain-driven management strategy for cardio toxicity monitoring, which failed to meet its primary endpoint. The jury is still out on the usefulness of LV strain for this indication.

### **Q7: What category of patient will benefit the most from GLS?**

#### **A7 Notable Response:**

**@juancplana:** Patients at high risk for CTRCD: Old patients, patients with CV risk factors or borderline LVEF at baseline

**@mariellesc1:** Patients who are at high risk of CHF (hematological malignancies, EF at the lower limits of normal) to help triage

### **Q8: What to do with a patient with normal EF but reduced GLS?**

#### **A8 Notable Responses:**

**@VLSorrellImages:** Important Q- IMHO this is case by case.

1st- Confirm serial drop in GLS is accurate

2nd- review all data (look for Trop/BNP)

3rd- close follow up/ repeat echo/GLS

4th- discuss with Oncology

**@iamritu:** This is a common clinically encountered scenario - it depends on the clinical context

**@onco\_cardiology:** First, check if measurement is good, look carefully at those tracings, check for changes in BP or clinical evidence of hypovolemia. Then, look for evidence of LV remodeling/ dilatation, I feel more comfortable if I see this, to start BB/ACEI

**@oslermarine:** Agree with @onco\_cardiology BP and volume status are important factors, I see a drop in GLS as an opportunity to screen patients for CV risk factors and modify them.

**@mariellesc1:** treat risk factors, if HT, prescribe beta-blockers/ACEi/ARB that have shown some effect on the decrease of LVEF in patients treated with chemotherapy. Statins?

**@DavidWienerMD:** Strain in this scenario has uses beyond oncology. Strain is included in the 2021 @escardio valve guideline, where GLS <-15% is a risk marker of subclinical LV dysfunction in severe asymptomatic AS with a normal LVEF.

## 2021 ESC/EACTS Guidelines for the management of valvular heart disease

Developed by the Task Force for the management of valvular heart disease of the European Society of Cardiology (ESC) and the European Association for Cardio-Thoracic Surgery (EACTS)

**Authors/Task Force Members:** Alec Vahanian <sup>✉</sup> (ESC Chairperson) (France), Friedhelm Beyersdorf<sup>1</sup> (EACTS Chairperson) (Germany), Fabien Praz (ESC Task Force Coordinator) (Switzerland), Milan Milojevic<sup>1</sup> (EACTS Task Force Coordinator) (Serbia), Stephan Baldus (Germany), Johann Bauersachs (Germany), Davide Capodanno (Italy), Lenard Conrad<sup>1</sup> (Germany), Michele De Bonis<sup>1</sup> (Italy), Ruggero De Paulis<sup>1</sup> (Italy), Victoria Delgado (Netherlands), Nick Freemantle<sup>1</sup> (United Kingdom), Martine Gilard (France), Kristina H. Haugaa (Norway), Anders Jeppsson<sup>1</sup> (Sweden), Peter Juni (Canada), Luc Pierard (Belgium), Bernard D. Prendergast (United Kingdom), J. Rafael Sádaba<sup>1</sup> (Spain), Christophe Tribouilloy (France), Wojtek Wojakowski (Poland), ESC/EACTS Scientific Document Group

<sup>✉</sup> Corresponding author: Alec Vahanian, UFR Médecine, Université de Paris, site Beclard, 16 rue Huchard, 75018 Paris, France and LVTS INSERM U1148, GH (Beclard, 46, rue Jean-Huchard, 75018 Paris, France. Tel.: +33 1 43 15 54 48. E-mail: alex.vahanian@gmail.com; Friedhelm Beyersdorf, Department of Cardiovascular Surgery, University Heart Center, University Hospital Freiburg, Germany and Medical Faculty of the Albert-Ludwigs-University, Freiburg, Germany. E-mail: beyersdorf@med1.uni-freiburg.de

**Author/Task Force Member affiliations listed in Author information.**

**ESC Clinical Practice Guidelines Committee (CPG) listed in the Appendix.**

**EACTS Council listed in the Appendix.**

**\*Representing the European Association for Cardio-Thoracic Surgery (EACTS)**

**ESC subjectivity committees having participated in the development of this document:**

**Associations:** Association for Adult Cardiovascular Care (ACCVC), European Association of Cardiovascular Imaging (EACVI), European Association of Percutaneous Cardiovascular Interventions (EAPCI), European Heart Rhythm Association (EHRA), Heart Failure Association (HFA).

**Councils:** Council on Women's Heart Disease.

**Working Groups:** Cardiovascular Surgery, Thoracic.

**Patient Forum:**

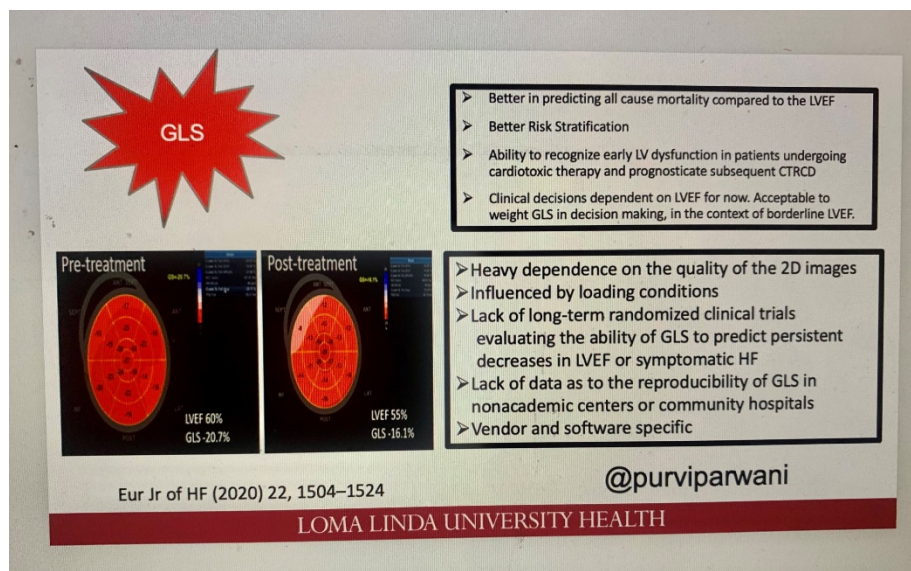
The content of these European Society of Cardiology (ESC) / European Association for Cardio-Thoracic Surgery (EACTS) Guidelines has been published for personal and educational use only. No commercial use is authorized. No part of the ESC/EACTS Guidelines may be translated or reproduced in any form without written permission from the ESC and the EACTS. Permission can be obtained upon submission of a written request to Oxford University Press, the publisher of the European Heart Journal and the party authorized to handle such permissions on behalf of the ESC (journals.permissions@oup.com).

**Disclaimer:** The ESC/EACTS Guidelines represent the views of the ESC and the EACTS and were produced after careful consideration of the scientific and medical knowledge and the evidence available at the time of their publication. The ESC and the EACTS are not responsible in the event of any contradiction, discrepancy or other ambiguity between the ESC/EACTS Guidelines and any other official recommendations or guidelines issued by the relevant public health authorities, in particular in relation to good use of health care or therapeutic strategies. Health professionals are encouraged to take the ESC/EACTS Guidelines fully into account when assessing their clinical judgment, as well as in the determination and the implementation of preventive, diagnostic or therapeutic medical strategies; however, the ESC/EACTS Guidelines do not override, in any way whatsoever, the individual responsibility of health professionals to make appropriate and accurate decisions in consideration of each patient's health condition and in consultation with that patient and, where appropriate and/or necessary, the patient's caregiver. Nor do the ESC/EACTS Guidelines exempt health professionals from taking into full and careful consideration the relevant official updated recommendations or guidelines issued by the competent public health authorities, in order to manage each patient's case in light of the scientifically accepted data pursuant to their respective ethical and professional obligations. It is also the health professional's responsibility to verify the applicable rules and regulations relating to drugs and medical devices at the time of prescription.

This article has been published with permission in the European Heart Journal and European Journal of Cardio-Thoracic Surgery. © the European Society of Cardiology and the European Association for Cardio-Thoracic Surgery 2021. All rights reserved. The articles are identical except for minor stylistic and spelling differences in keeping with each journal's style. Other citation can be used when citing this article. For permissions, please email journals.permissions@oup.com.

**@tdbauch:** It will help to have many more outcome trials that randomize Valve disease, Oncology cases, and other proposed GLS population, to usual care vs GLS guided care. So far seems mostly retrospective data despite many years of available GLS technology?

**@purviparwani:** Important to realize the variability and shortcomings of GLS on #Echofirst before any Mx changes (guidelines currently don't support changes based on GLS alone) (See limitations of GLS in slide below)



**@DrA\_FACC:** With respect to #CardioOnc: if GLS Downwards arrow >10%-15% (I believe), but EF Left right arrow & normal, no guidelines advise changing chemoRx mgmt. I do think though we ought to be monitoring these pts more frequently, be more aggressive with meds and consider doubleWhite heavy check mark EF with #yesCMR

**@BravuraGeorgio:** Opportunity to investigate further; look for thick LV walls, HCM, amyloid, other infiltrative disorders etc that need immediate Rx or preempt disease and use preventive therapy rather than wait for disease to manifest clinically. Helps understand how disease develops over time etc

**Q9: What were the most important results of the SUCCOUR trial?**

**A9 Notable Responses:**

**@juancplana:** A shortcoming of the study is that the outcome of the study was adjudicated using 3D, which happens to be the same strategy evaluated in one if the arms of the study. An independent imaging modality (CMR) would have made more sense. I believe help is on the way by @tom\_marwick

**@ambergtaylorgm1:** that a bigger trial is needed in this field

**Q10: Will you change your practice based on the SUCCOUR trial?**

**A10 Notable Responses:**

**@onco\_cardiology:** More data needed. GLS changes at this time don't trigger changes in management in my practice. LVEF<50% definitely does

**@AlexFASE27:** Not at this time, a larger study seems necessary first.

**@mariellesc1:** At this point, SUCCOUR has not changed my practice fundamentally. I use strain mostly to triage high risk patients.