

Cardioncologia

Ecocardiografia avanzata per la diagnosi precoce della disfunzione cardiaca

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INTRODUZIONE

Cardiac Dysfunction/HF

Cardiac dysfunction or structural injury associated with cancer therapy, which can remain asymptomatic, or present as clinical HF, each defined ranging from mild to severe degree

(Table 1, Figure 2)

Myocarditis

Toxicity or immune-mediated inflammation of the myocardium, associated with various cancer therapies, especially immune checkpoint inhibitors, defined by major and minor diagnostic criteria

(Table 2)

Arrhythmias/ QT Prolongation

A QT interval >500 ms, measured by the Fridericia formula, is defined as prolonged. Supraventricular and ventricular arrhythmias are defined as per standard practice

(Table 5, Figure 3)

Definition of Key Cardiovascular Toxicities

Hypertension

Elevation in systolic and/or diastolic blood pressure after initiation of cancer therapy without any other contributing changes.

130/80 mmHg and 140/90 mmHg are defined as diagnostic and therapeutic thresholds according to co-morbidities

(Table 4)

Vascular Toxicity

Induction or aggravation of vascular disease caused by cancer therapy; vascular toxicity may be transient or sustained, symptomatic or asymptomatic, defined by standard criteria

(Table 3)



2D - Frazione di Eiezione (FE) non basta più da sola

Punti di forza

- **Metodica standardizzata e universalmente compresa.**
- **Indicatore ancora centrale per definire la funzione ventricolare.**
- **Facile da integrare nel follow-up routinario.**

Limiti principali

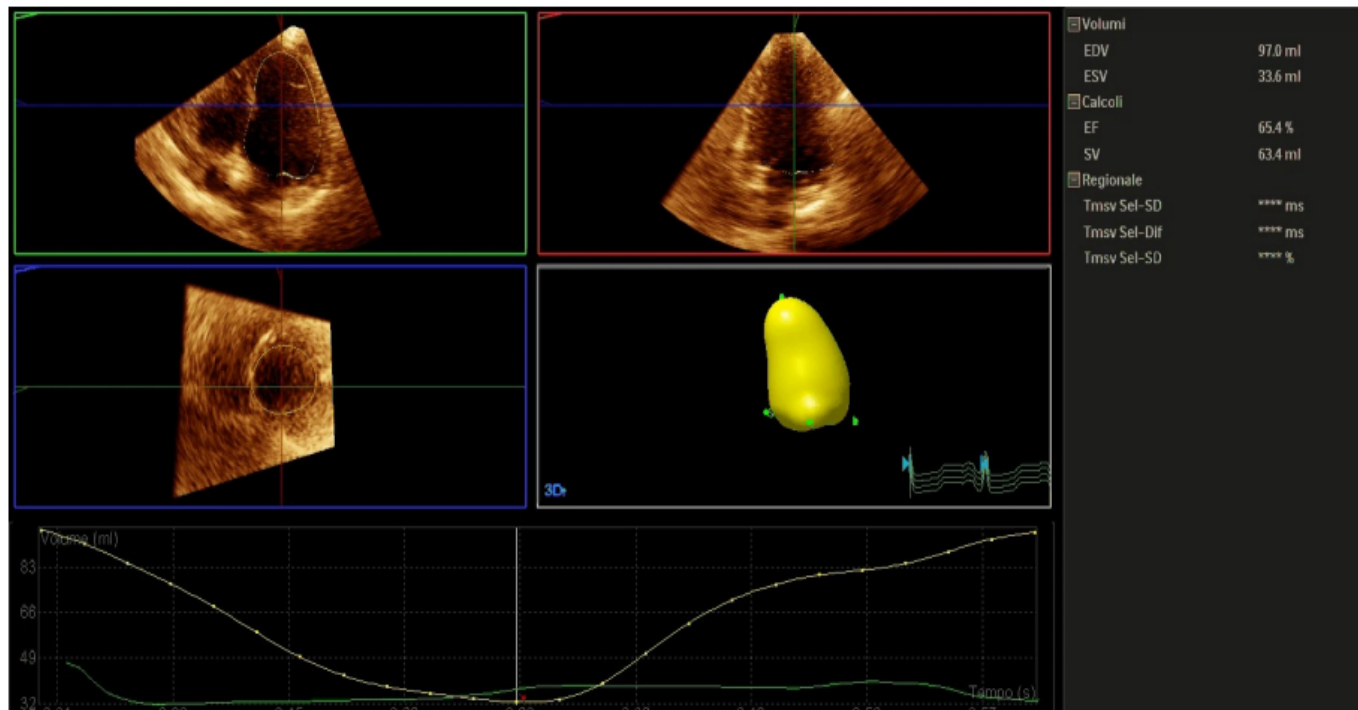
- **Scarsa sensibilità per il danno subclinico.**
- **La riduzione della FE può comparire tardivamente.**



Quando parliamo di ecocardiografia avanzata non stiamo sostituendo l'ecocardiografia bidimensionale tradizionale, ma la stiamo potenziando, integrando parametri convenzionali, quale la FE, con altri più precoci e sensibili di danno miocardico.



Three – Dimensional (3D) Echocardiography



Three – Dimensional (3D) Echocardiography

VANTAGGI

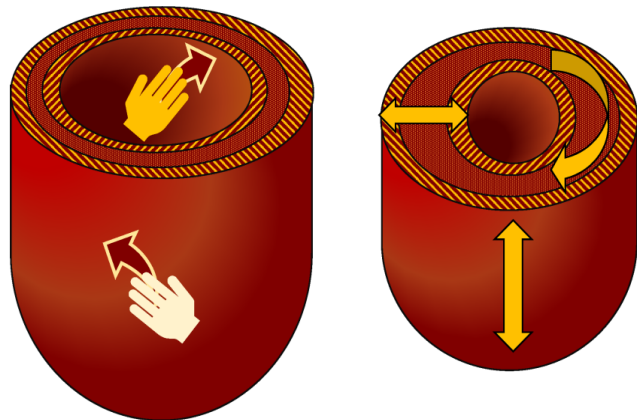
- Calcolo dei volumi non risente delle assunzioni geometriche del metodo Simpson
- Misure automatiche e semi-automatiche
- Riproducibile
- Minor variabilità temporale
- Minor variabilità intraoperatore

SVANTAGGI

- Qualità delle immagini 2D
- Anomalie del ritmo cardiaco
- Variabilità inter-vendor
- Disponibilità



Strain miocardico



Heart 2020; 0: 1 -7

Lo **strain** descrive la deformazione del miocardio in senso longitudinale, radiale, e circonferenziale. E' un parametro adimensionale che descrive la variazione in lunghezza tra 2 punti:

$$\text{Strain } (\epsilon) = \frac{L - L_0}{L_0}$$

L_0 : lunghezza iniziale

L : lunghezza dopo deformazione

Per convenzione:

Accorciamento

Allungamento

Strain negativo

Strain positivo

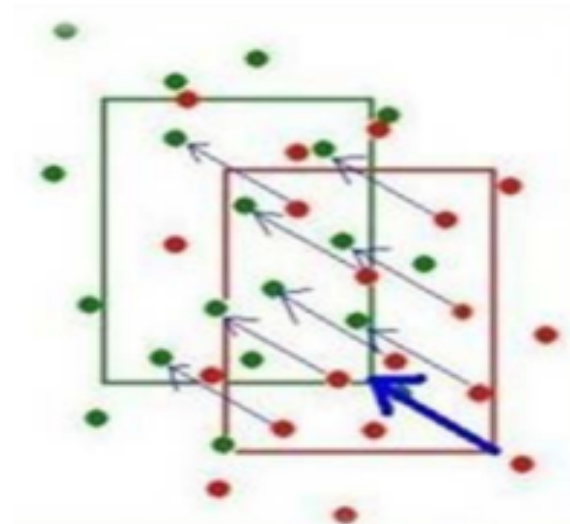
Strain Rate (SR) =
deformazione nell'unità
di tempo (velocità)



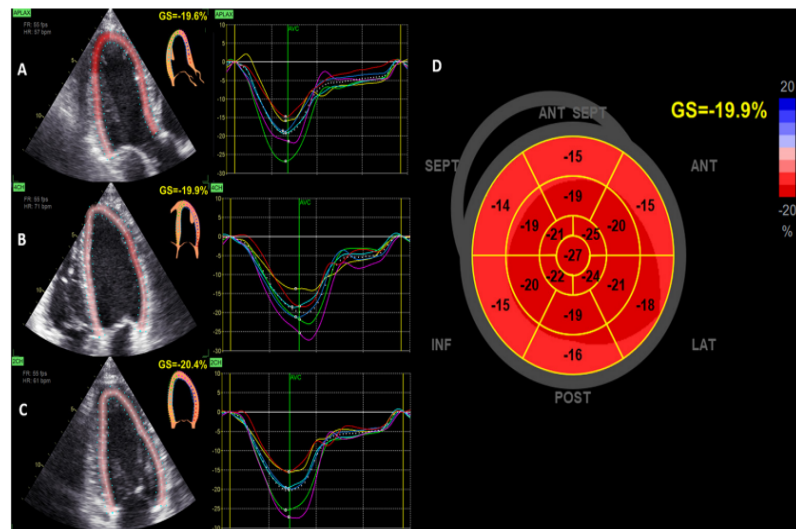
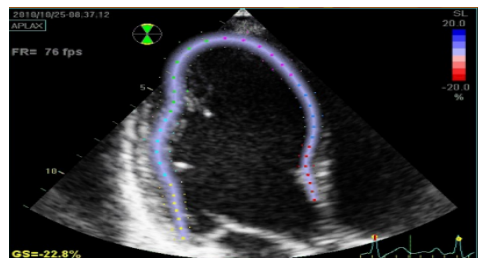
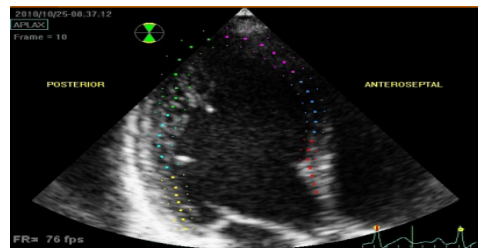
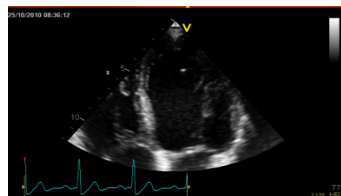
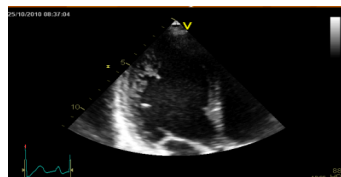
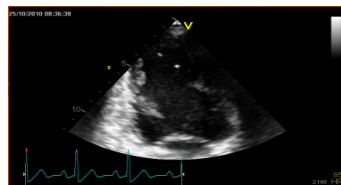
Speckle-Tracking Echocardiography

La tecnica dello speckle tracking si basa sul fatto che l'interazione degli ultrasuoni con il miocardio genera dei markers acustici detti "speckles" che possono essere seguiti nel loro spostamento durante il ciclo cardiaco.

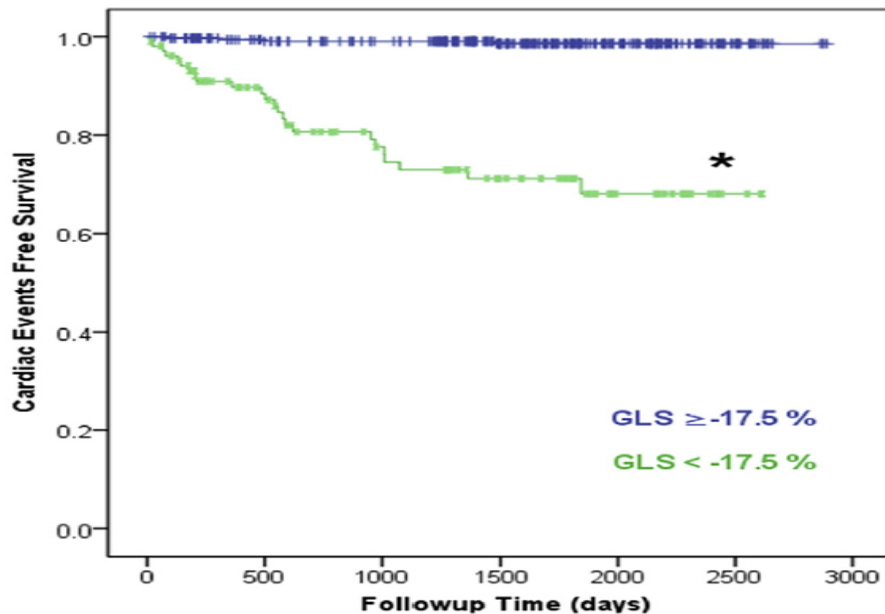
Lo spostamento degli speckles può essere usato per calcolare le velocità tissutali, lo strain(S) e lo strain rate(S/R) miocardico.



Speckle-Tracking Echocardiography Global Longitudinal Strain (GLS)



Speckle-Tracking Echocardiography Global Longitudinal Strain (GLS)

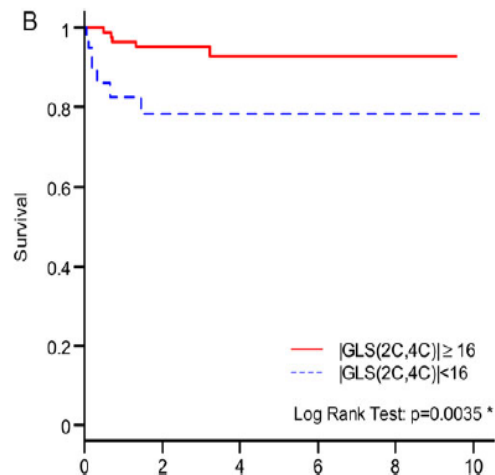
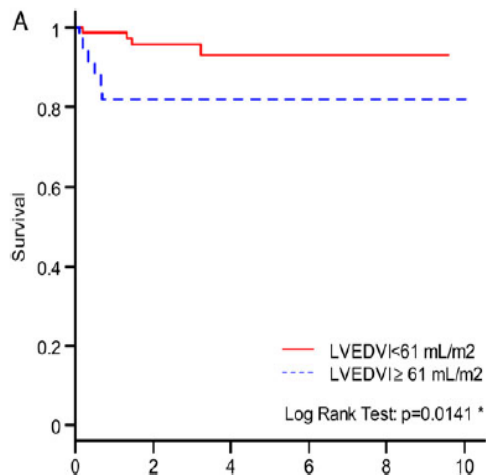
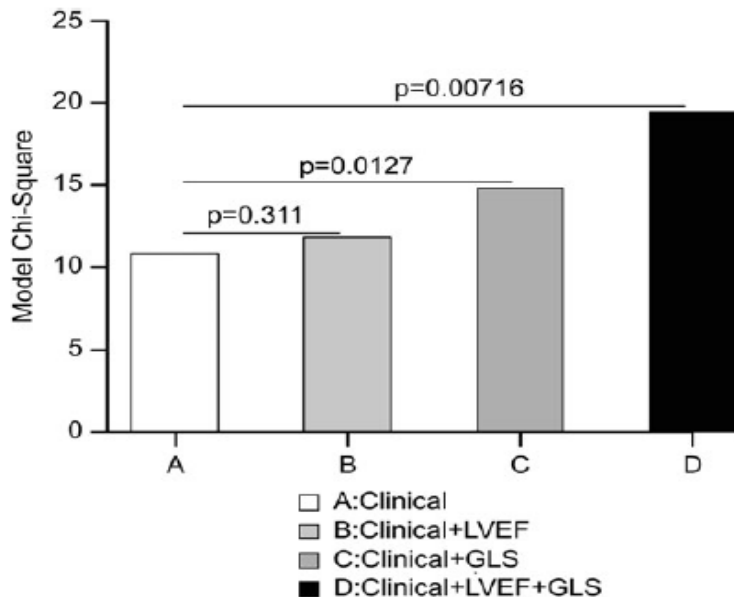


J Am Soc Echocardiogr 2016; 29:522-7

Pts with GLS $\geq$ -17.5	345	298	275	203	100	27	0
Pts with GLS <-17.5	105	72	52	37	17	3	0



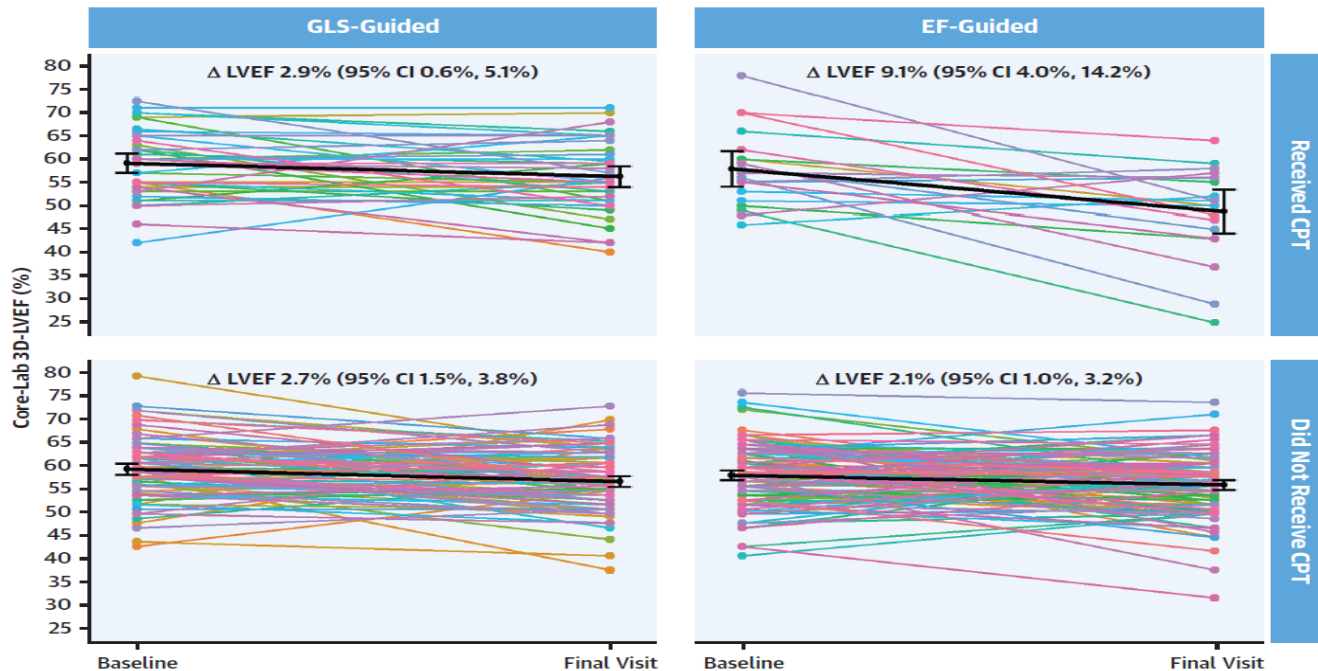
Speckle-Tracking Echocardiography Global Longitudinal Strain (GLS)



Eur Heart J Cardiovasc Imaging 2015; 16: 977-84



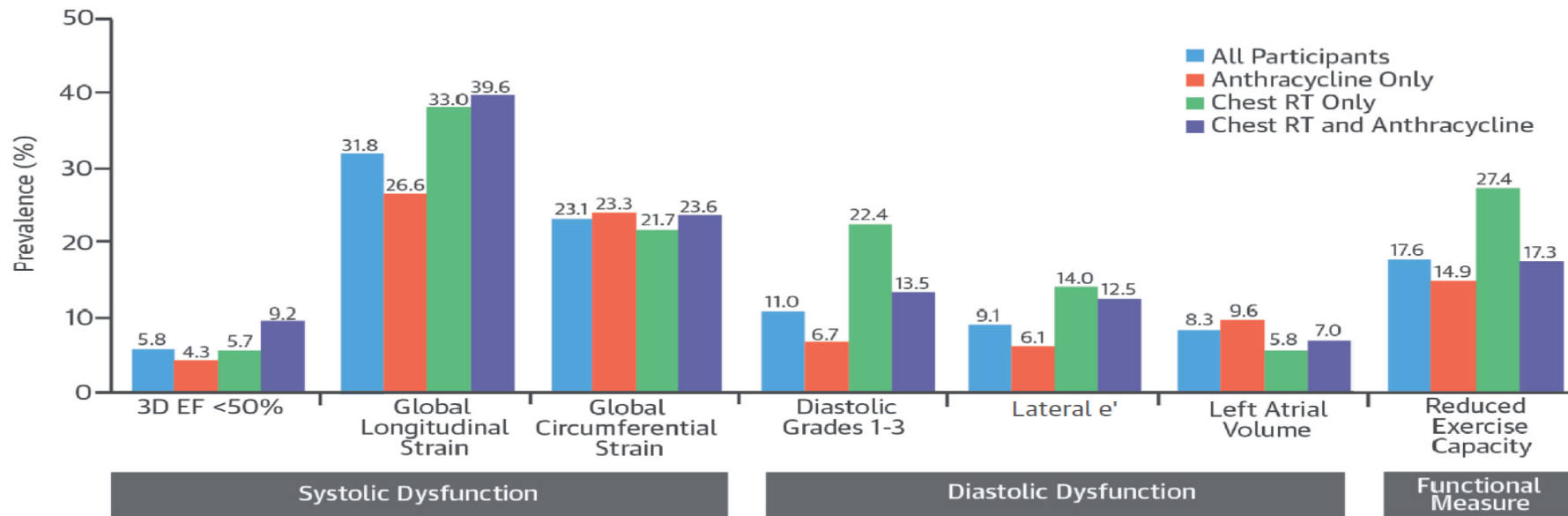
Speckle-Tracking Echocardiography Global Longitudinal Strain (GLS)



J Am Coll Cardiol 2021; 77:392-401



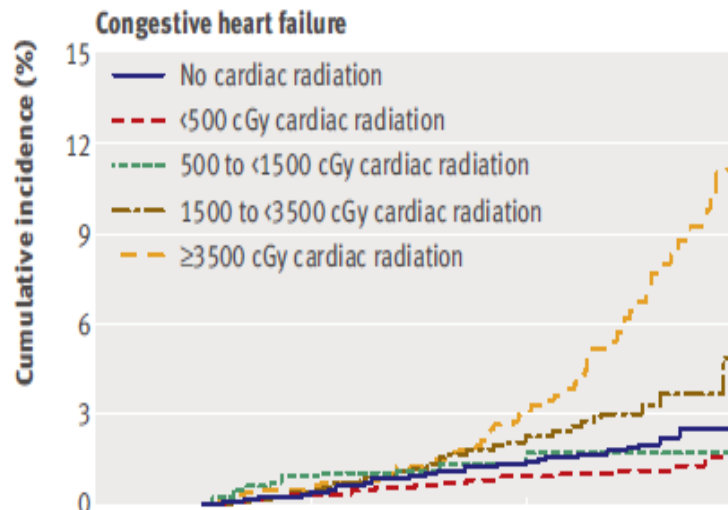
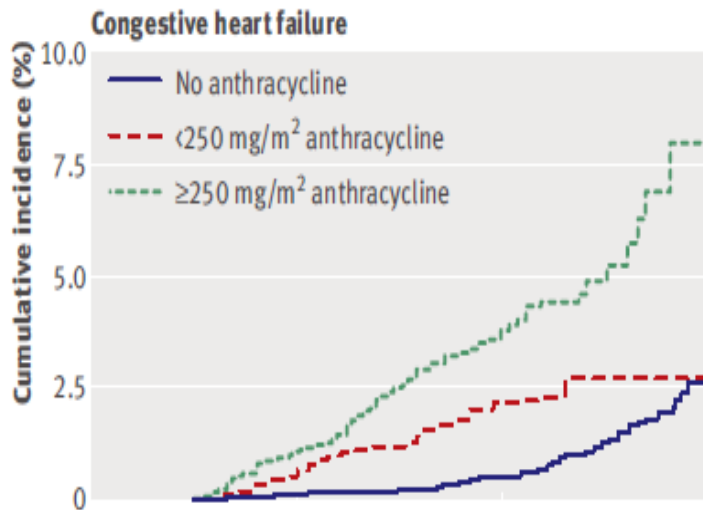
Speckle-Tracking Echocardiography Global Longitudinal Strain (GLS)



J Am Coll Cardiol 2015; 65: 2511 - 20



Speckle-Tracking Echocardiography Global Longitudinal Strain (GLS)



BMJ 2009; 339: b4606



Speckle-Tracking Echocardiography Global Longitudinal Strain (GLS)

CTRCD		
CTRCD sintomatica (SC) ^{a,b}	Molto severa	SC che necessita di supporto inotropo, supporto meccanico al circolo o eventuale trapianto cardiaco
	Severa	Ospedalizzazione per SC
	Moderata	Necessità di intensificare il trattamento con diuretici e la terapia dello SC a livello ambulatoriale
	Lieve	Sintomi lievi di SC, nessuna necessità di intensificare la terapia
CTRCD asintomatica	Severa	Nuova riduzione della FEVS a valori <40%
	Moderata	Nuova riduzione della FEVS di almeno il 10% fino a raggiungere valori compresi tra 40-49% <i>OPPURE</i> Nuova riduzione della FEVS inferiore al 10% fino a raggiungere valori compresi tra 40-49% associati ad una nuova riduzione relativa del GLS di oltre il 15% rispetto al basale OPPURE nuova elevazione del biomarker cardiaci
	Lieve	FEVS $\geq 50\%$ E nuova riduzione relativa del GLS di oltre il 15% rispetto al basale E/O nuova elevazione del biomarker cardiaci

G Ital Cardiol 2023; 24 (2 Suppl 1): e1 - e130



Speckle-Tracking Echocardiography *Global Longitudinal Strain (GLS)*

GUIDELINES AND STANDARDS

Clinical Applications of Strain
Echocardiography: A Clinical Consensus
Statement From the American Society of
Echocardiography Developed in
Collaboration With the European Association
of Cardiovascular Imaging of the European
Society of Cardiology

J Am Soc Echocardiogr 2025; 38 (11): 985 - 1020



Speckle-Tracking Echocardiography *Global Longitudinal Strain (GLS)*

VANTAGGI

- Alta sensibilità per danno subclinico
- Ripetibile
- Riduce i tempi di acquisizione
- Basso costo
- Non invasivo

SVANTAGGI

- Qualità dell'esame
- Curva di apprendimento più ripida
- Variabilità inter-vendor
- Influenzato da preload e afterload del Vsn



Altre tecniche:

- ❖ *3D-Eco del ventricolo destro*
- ❖ *Longitudinal Strain (LS) del ventricolo destro*
- ❖ *Strain dell'atrio sinistro*
- ❖ *3D Strain del ventricolo sinistro e destro*
- ❖ *Myocardial Work by pressure-strain analysis*



Non dimentichiamo:

- ***Imaging cardiaco***
- ***Marcatori sierici di danno miocardico***



**APPROCCIO
SINERGICO**

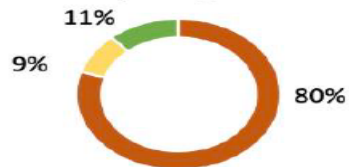


CONCLUSIONI



159 Echocardiography Centers from ANMCO/SIECVI

Participating Centers



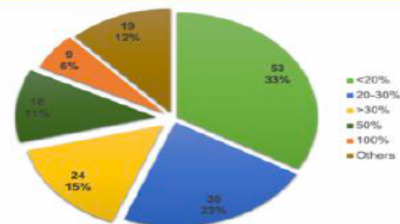
- General Hospitals with Oncology
- Highly-Specialized Oncologic Centers
- Outpatient Clinics



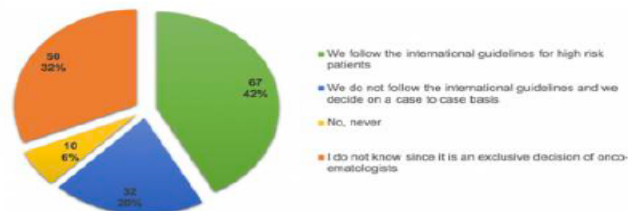
Pre-specified sub-analysis: presence or absence (33% vs 77%) of cardiologists with expertise in Cardio-Oncology

Main results

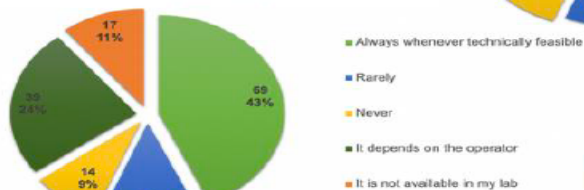
% of Echocardiograms required for Onco-hematologic patients



Integration with cardiac biomarkers



GLS Use



Conclusion

Our survey reveals a significant gap between echocardiography use in clinical practice and proposed standards by ESC guidelines and other scientific societies. Dedicated education in the field of Cardio-Oncology and diffusion of specialized units caring for cardiac diseases in cancer patients are needed.

Current Use of Echocardiography in Cardio-Oncology: Results From An ANMCO/SIECVI Joint Survey

Eur Heart J - Imaging Methods and Practice (2024) 2, qyae081

