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CARDIOLOGY**
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Implication of 2D speckle tracking deformation imaging in early detection and management of children underwent Anthracycline induced cardiotoxicity

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Background



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Background

- Anthracycline drugs are effective antineoplastic agents used for a wide spectrum of malignancies.
- The most serious side effect of anthracycline chemotherapy is progressive dose-dependent LV dysfunction even years after the treatment has been completed.



Background

- It leads to:
 1. Myocyte loss.
 2. Interstitial fibrosis
 3. Reduced ventricular wall thickness.
 4. Progressive LV dilation.
 5. Anthracycline-induced LV dysfunction.
 6. Finally is associated with poor prognosis.



Background

- **Early detection of minor LV myocardial dysfunction is thus important for predicting possible occurrence of global anthracycline-induced LV dysfunction to facilitate early management.**



Background

- **The LV wall is not homogenous and is composed of 3 layers of fibers, with the endocardial layer is often the first to be affected by various diseases.**
- **Because this layer is mainly responsible for long axis contraction, a reduction in longitudinal function has been found to be an early and an accurate indicator of LV dysfunction with high susceptibility to fibrosis.**



Purposes



Purposes

- **To evaluate the role of 2D speckle tracking deformation imaging in early detection and management of subclinical impairment of systolic LV function in anthracycline treated children.**

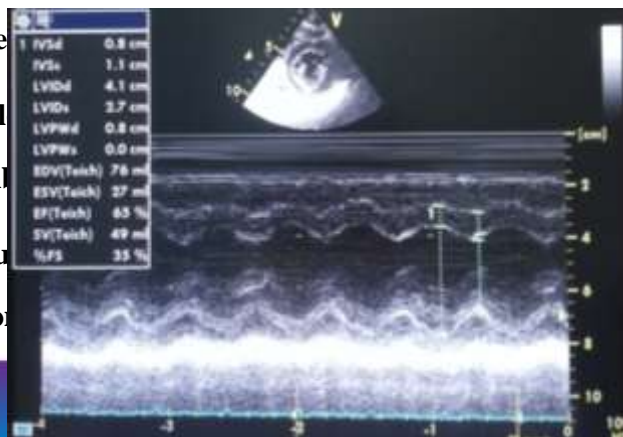


Methods



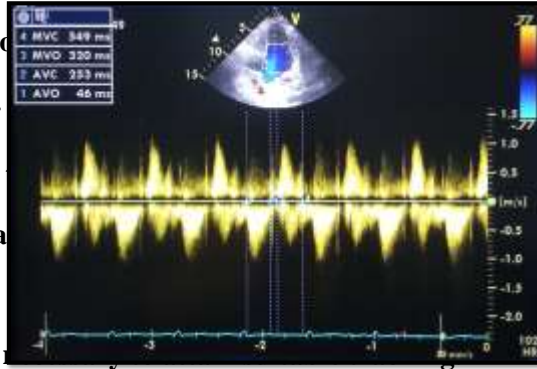
Methods

- One hundred and ten (110) anthracyclines treated patients who had structurally normal heart were recruited for this study (5 of the
- LVEF was calculated using the Teichholz method in the apical 4 chamber view
- FS was calculated using the Teichholz method in the parasternal long axis view

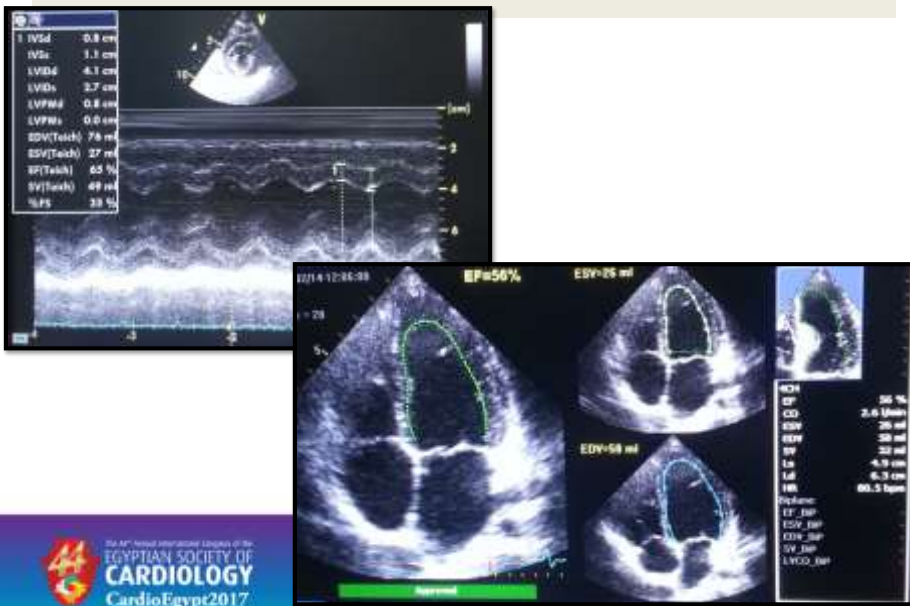


Methods

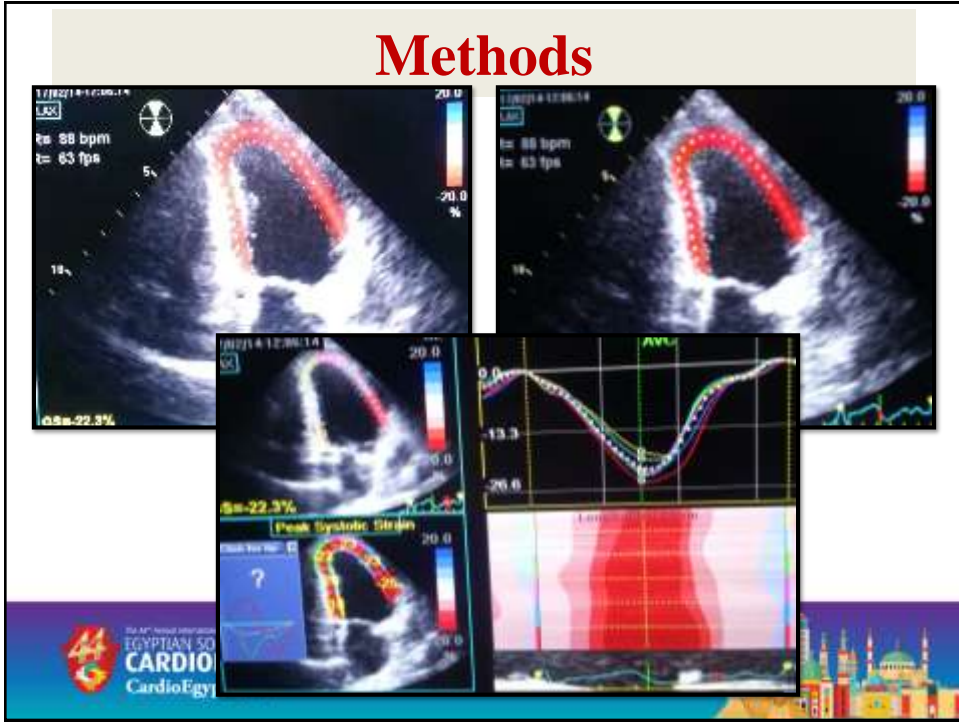
- Doppler-derived transmitral and transaortic velocities was obtained from the echocardiogram for event timing assessment.
- 2D speckle tracking was used to measure longitudinal systolic strain in the septum and lateral wall of the left ventricle. The regions of interest were defined in the end-diastolic frame and retraced as endocardial borders.
- These parameters were compared to the same parameters in twenty age matched controls.



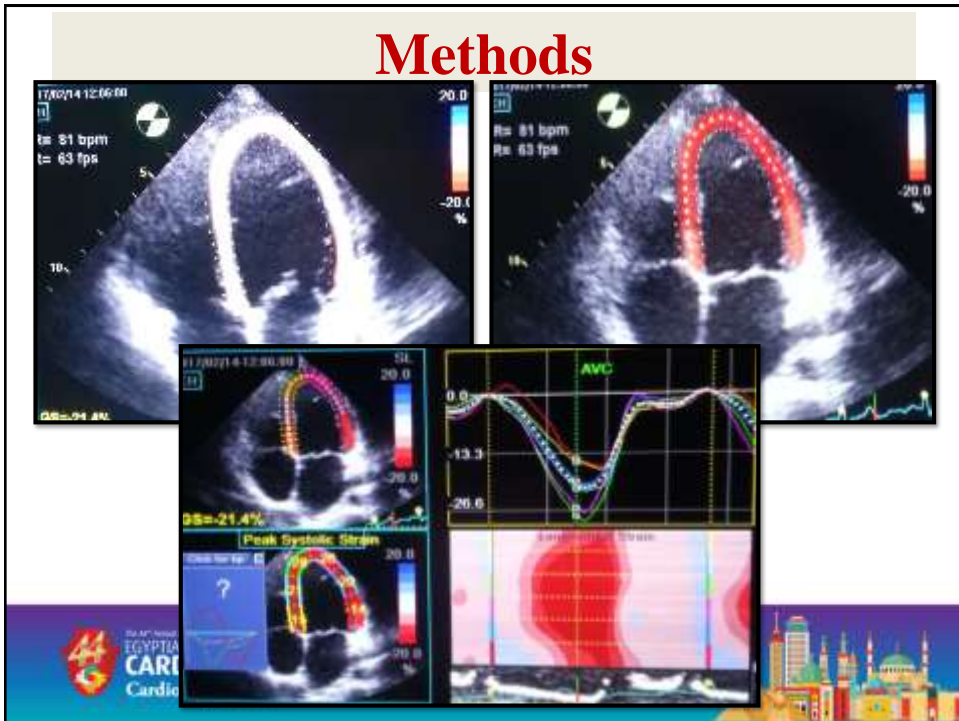
Methods



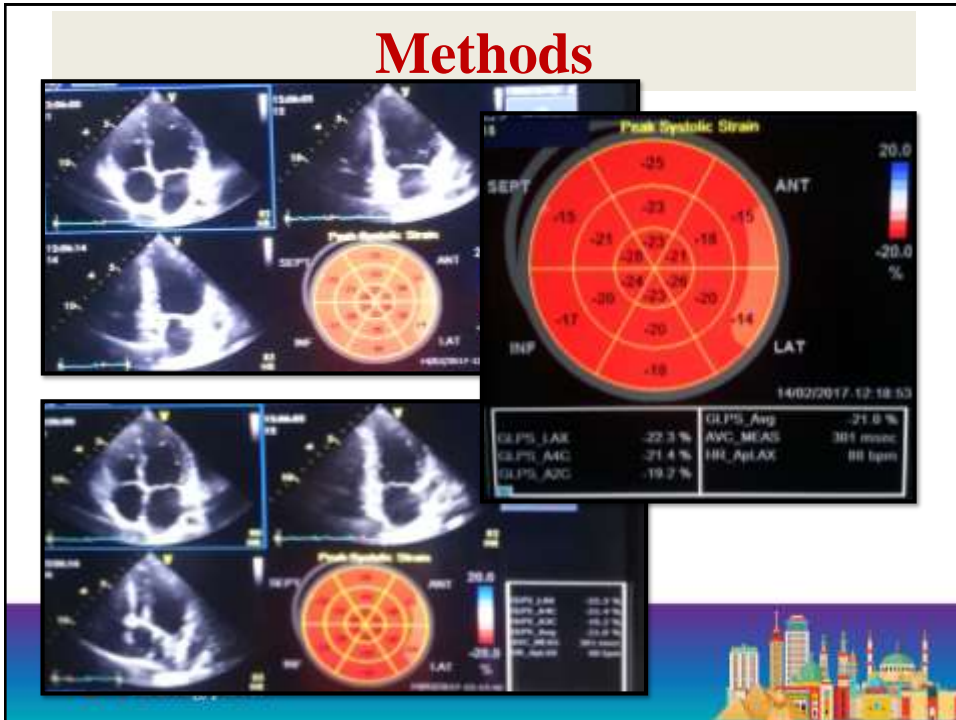
Methods



Methods



Methods



Methods

Depending on global LVEF :

Group I

**LVEF
50-65 %**

Group II

**LVEF
> 65%.**

Methods

- **Cardiac supportive management was started with impaired global LV systolic function as impaired global longitudinal strain more than -19 % (The worst value in the control group) irrespective of LVEF and FS values.**
- **Cardiac supportive management included ACEI (captopril), spironolactone and sometimes B- blocker carvedilol (in absence of NYHA class III/IV heart failure).**



Methods

- **These cardiologically supported patients underwent Follow up echo by the same echo parameters every two weeks.**
- **All data taken were collected and analyzed.**



Results



Results

Table 1: Baseline characteristics of the patients and the controls.

	Anthracycline Group (n = 110)	Control Group (n = 20)	P-Value
Age (years)	11.04 ± 3.78	12 ± 1.76	0.39
Gender (male/female)	76/34	12/8	0.38
Type of cancer, n (%)			
Non-Hodgkin lymphoma	49 (44.5%)		
Hodgkin lymphoma	14 (12.7%)		
Leukemia	15 (13.6%)		
Breast cancer	9 (8.2%)		
Osteosarcoma	3 (2.7%)		
Others	20 (18.2%)		



Results

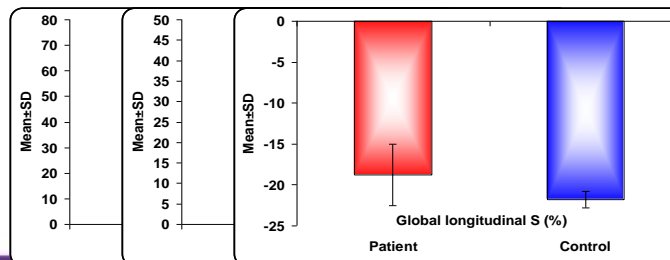
Table 2: Echocardiographic characteristics of patients and controls.

	Anthracycline Group (n = 110)	Control Group (n = 20)	P-Value
LVEDD (mm)	41 ± 6	39 ± 5	0.39
LVESD (mm)	27 ± 4	25 ± 4	0.38
LVEDV (mL)	52.09 ± 29.38	41.15 ± 12.10	<0.001*
LVESV (mL)	24.62 ± 14.00	18.35 ± 4.43	<0.001*

Results

Table 3: Comparison of LVS function between patients and controls.

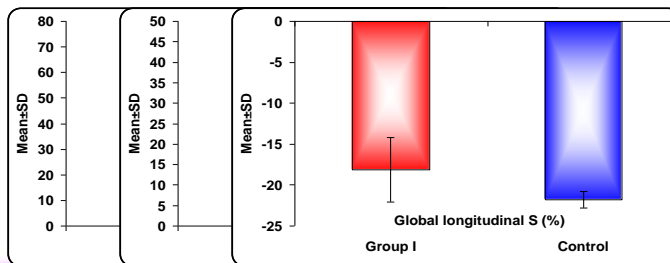
	Patients	Controls	P value
LVEF (%)	62.08 ± 6.81	69.40 ± 6.52	<0.001*
LVFS (%)	33.36 ± 5.02	39.00 ± 5.77	<0.001*
GLS (%)	-18.78 ± 3.72	-21.82 ± 1.02	<0.001*



Results

Table 4: Comparison of LVS function between group I and controls.

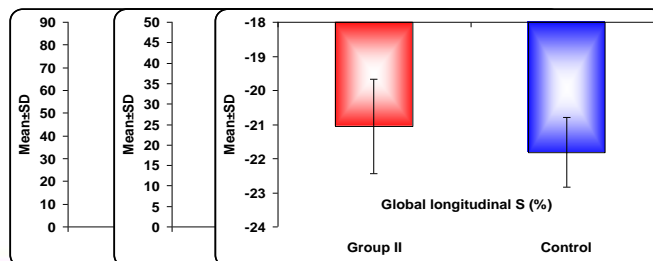
	Group I	Controls	P value
LVEF (%)	59.36 ± 4.38	69.40 ± 6.52	<0.001*
LVFS (%)	31.45 ± 3.08	39.00 ± 5.77	<0.001*
GLS (%)	-18.15 ± 3.92	-21.82 ± 1.02	<0.001*



Results

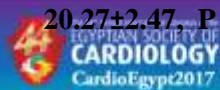
Table 5: Comparison of LVS function between group II and controls.

	Group II	Controls	P value
LVEF (%)	71.83 ± 4.66	69.40 ± 6.52	0.157
LVFS (%)	40.17 ± 4.73	39.00 ± 5.77	0.465
GLS (%)	-20.84 ± 1.68	-21.82 ± 1.02	0.05*



Results

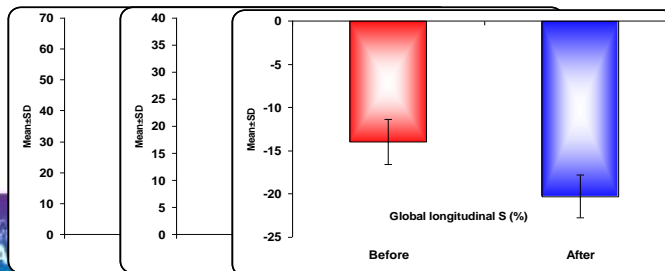
- Forty one anthracycline treated children (48%) of group I and three children (12.5%) of group II showed impaired LV GLS with S wave more than -19%.
- These 44 patients underwent continuous cardiac supportive therapy and showed significant improvement of LVEF from $58.09 \pm 5.54\%$ to $63.33 \pm 2.47\%$, $P < 0.001^*$, FS from $30.86 \pm 3.73\%$ to $33.7 \pm 2.19\%$, $P < 0.001^*$ and GLS from -15.22 ± 2.82 to -20.27 ± 2.47 , $P < 0.001^*$.

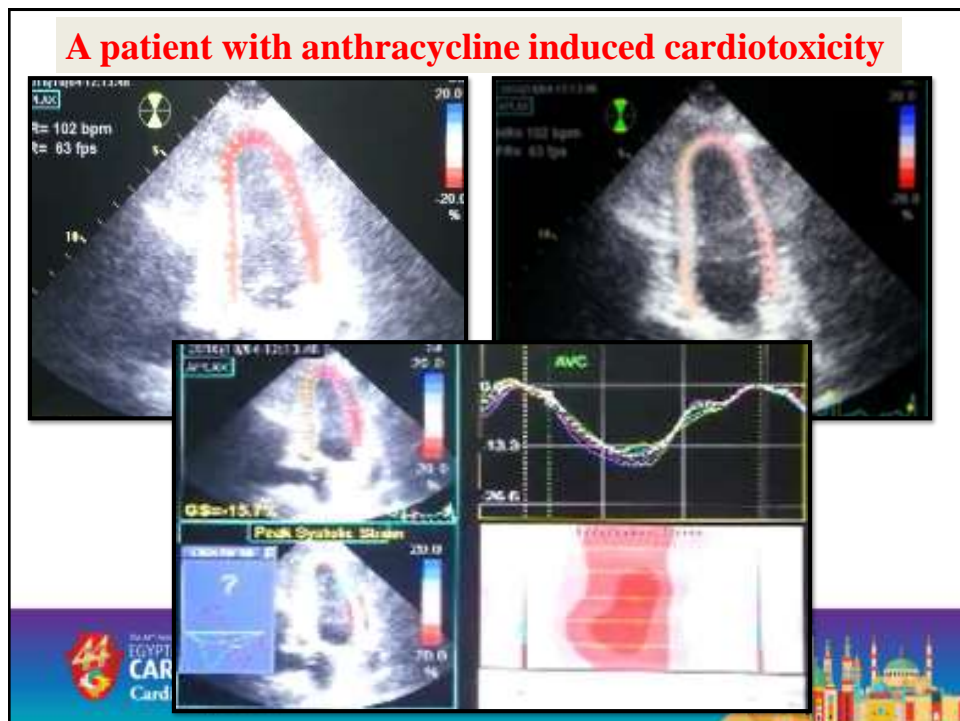
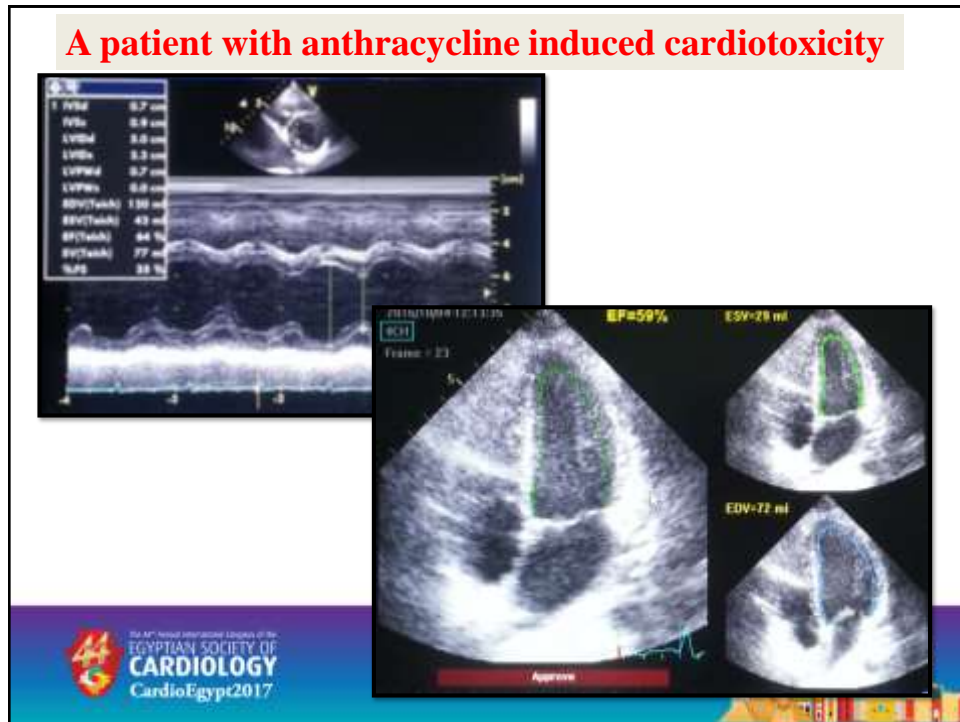


Results

Table 6: Comparison of LVS function before and after cardiac supportive therapy.

	Before cardiac therapy	On cardiac therapy	P value
LVEF (%)	58.09 ± 5.54	63.33 ± 2.47	$<0.001^*$
LVFS (%)	30.86 ± 3.73	33.7 ± 2.19	$<0.001^*$
GLS (%)	-15.22 ± 2.82	-20.27 ± 2.47	$<0.001^*$

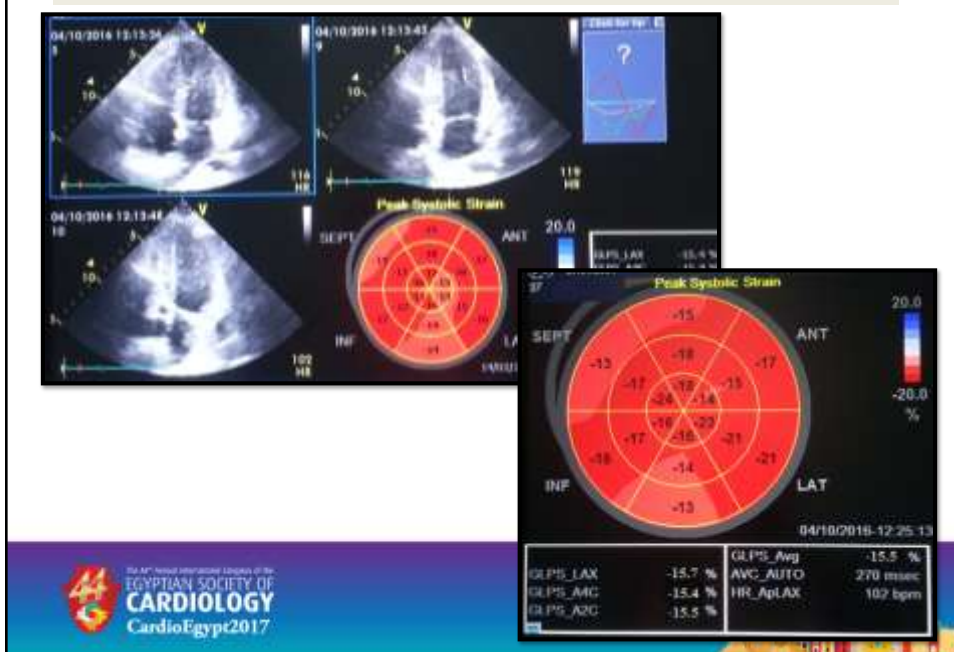




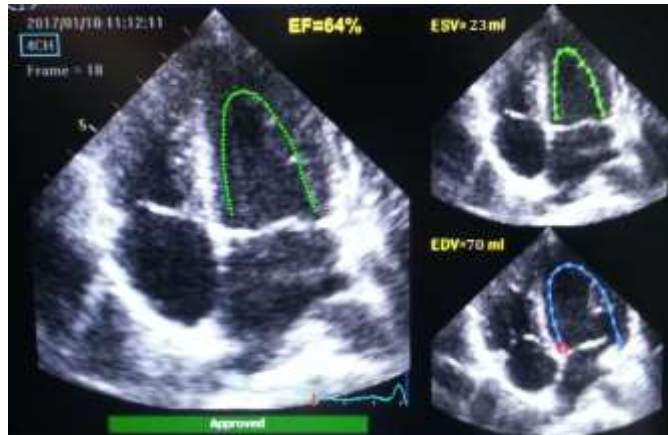
A patient with anthracycline induced cardiotoxicity



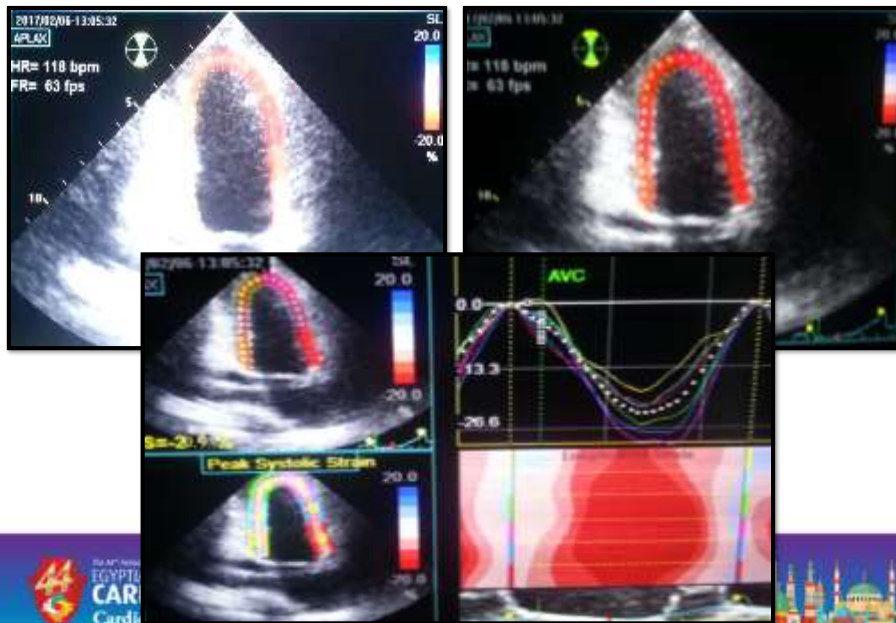
A patient with anthracycline induced cardiotoxicity



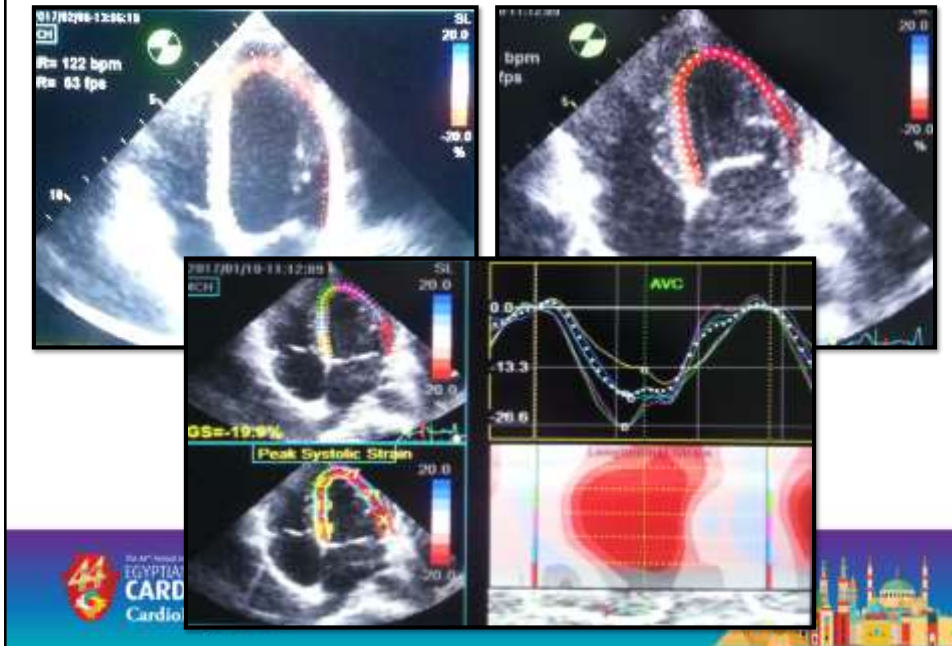
The same patient after cardiac supportive therapy



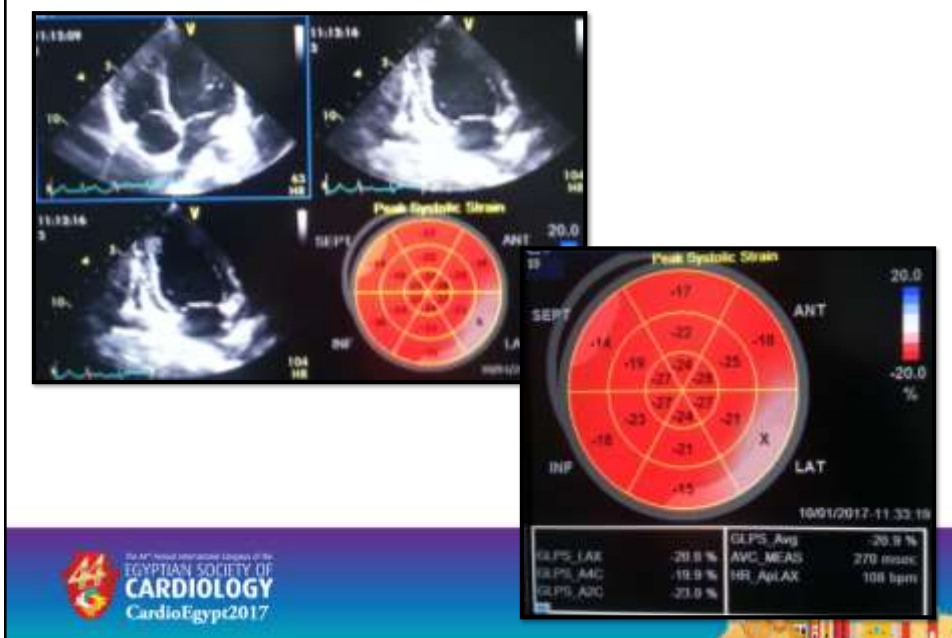
The same patient after cardiac supportive therapy



The same patient after cardiac supportive therapy



The same patient after cardiac supportive therapy



Conclusions



Conclusions

- **2D speckle tracking area strain was found useful for early detection of minor LV endocardial dysfunction associated with the use of anthracycline in children.**
- **This value was recorded not only in patients with suspected impaired subendocardial systolic function in whom LVEF 50-65%, but also in children with LVEF > 65%; in them despite their normal EF and FS, their GLS denotes early impairment of LV systolic function.**



Conclusions

- Because anthracycline causes changes in LV performance over time, watchful observation may be necessary for patients with preserved LV global function but with impaired LV endocardial function even after stoppage of anthracycline therapy.
- Speckle based strain is not only useful for detection of early global LV dysfunction but also in starting early management and subsequently early salvage of cardiac function and improvement of cardiac prognosis.



Thank you

