

# The first step of making echocardiograms noise-free

R. Kakihara<sup>1</sup>, N. Inou<sup>2</sup>, A. Kuramoto<sup>2</sup>, A. Inayoshi<sup>3</sup> - (1) Private Kakihara Clinic, Department of Cardiology, Toyohashi, Japan (2) Tokyo Institute of Technology, The department of Mechanical and Control Engineering, Tokyo, Japan (3) Private Kakihara Clinic, Echocardiography Laboratory, Toyohashi, Japan

**Background and purpose:** The development of echocardiography and its spread in clinical practice has been remarkable for its non-invasive and non-radiative method. But it still has some problems. One of them is noise from the lungs, subcutaneous fat tissue or thick chest wall, which are not observed in MRIs, CTs or myocardial scintigrams. These problems block precise analysis of the motion of the left ventricular wall. In order to work out a solution to this problem, we first tried to delete noises using the tissue intensity method. This study was approved by the Clinic's ethical committee and all procedures were performed in accordance with the Declaration of Helsinki of the World Medical Association.

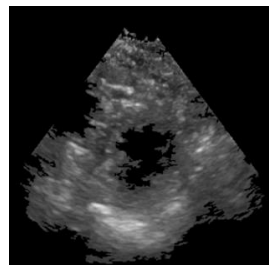
**Method:** The device used were GE Vivid E95 v 201 with a M5Sc 2D probe (1.4-4.6 MHz) and the EchoPAC PC version 201. The software we developed defined the pure white intensity as 0.00 dB and pure black as 255 dB. Noises were deleted by regulating their intensity using three parameters. Using the software the image was positioned properly by regulating the power-control bar and it tried to delete with gammare ( $\gamma$ ) bar and adaptive binarization parameters ( $\kappa$  and  $c$ ) regulating bars. The intensity of all of the original images were set  $\gamma : 0.5, \kappa : 151, c : 7$ .



**Results:** Twenty-six images of 11 patients were taken to this software and 15 images were successfully made noise-free. These renewed images were possible to be analyzed by strain or strain rate method. But eleven images failed to be noise-free enough to be analyzed precisely.



Original image  
 $\gamma$  0.5,  $\kappa$  151,  $c$  7



Noise – free image  
 $\gamma$  1.4,  $\kappa$  163,  $c$  110

Noise free image No.	$\gamma$	K	C
6	1.4	113	80
1	1.4	163	110
3	1.4	113	80
5	1.4	195	14
9	13.3	189	29
11	1	181	2
13	1.11	200	4
15	1.16	175	10
22	1.17	189	6
24	0.69	137	7
32	12	187	10
34	1.08	173	4
38	1.12	179	2
39	1.01	185	2
40	1.38	197	4
average	2.7	171.7	24.3
SD	$\pm 4$	$\pm 28.4$	$\pm 35.3$

**Conclusions:** The noise-free software we developed to make echocardiographic images noise-free was usable clinically, though only .avi format is available at present. This could make diagnostic accuracy of echocardiography better, and yet this is just the first step toward the finished version. We keep trying to develop a better system for noise-free echocardiography.