"Influence of Computed Tomography Attenuation Correction in Myocardial Perfusion Imaging, In Obese Population"
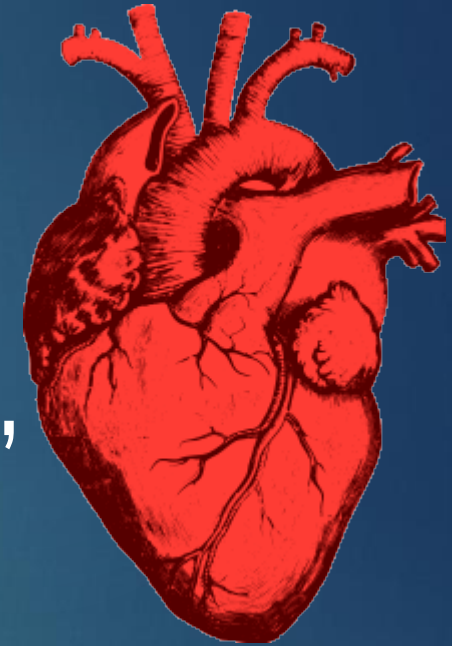
STAKHIV O.[1,2];CLARKE M.[2];APLIN M.[2];SINGH N. [2];DAY K.[2];DIZDAREVIC S.[2];JESSOP M.[2];SOUSA E.[1].

(1) LISBON SCHOOL OF HEALTH TECHNOLOGY, LISBON, PORTUGAL

(2) NUCLEAR MEDICINE, DEPARTMENT OF IMAGING, BRIGHTON AND SUSSEX UNIVERSITY HOSPITALS, NHS TRUST, BRIGHTON, UK.

Nothing To Declare

Summary

1. Introduction

MYOCARDIAL PERFUSION IMAGING

ACCURACY

ATTENUATION ARTIFACTS

MARKED REGIONAL VARIATIONS IN MYOCARDIAL ACTIVITY THAT ARE NOT RELATED TO MYOCARDIAL PERFUSION DEFECTS

COMPUTED TOMOGRAPHY ATTENUATION CORRECTION (CT-AC)

INCORPORATION OF CT-AC BMI > 27

Verify the influence of CT-AC in MPI results in patients with BMI between 30 and 35 and higher than 30 for male and female population
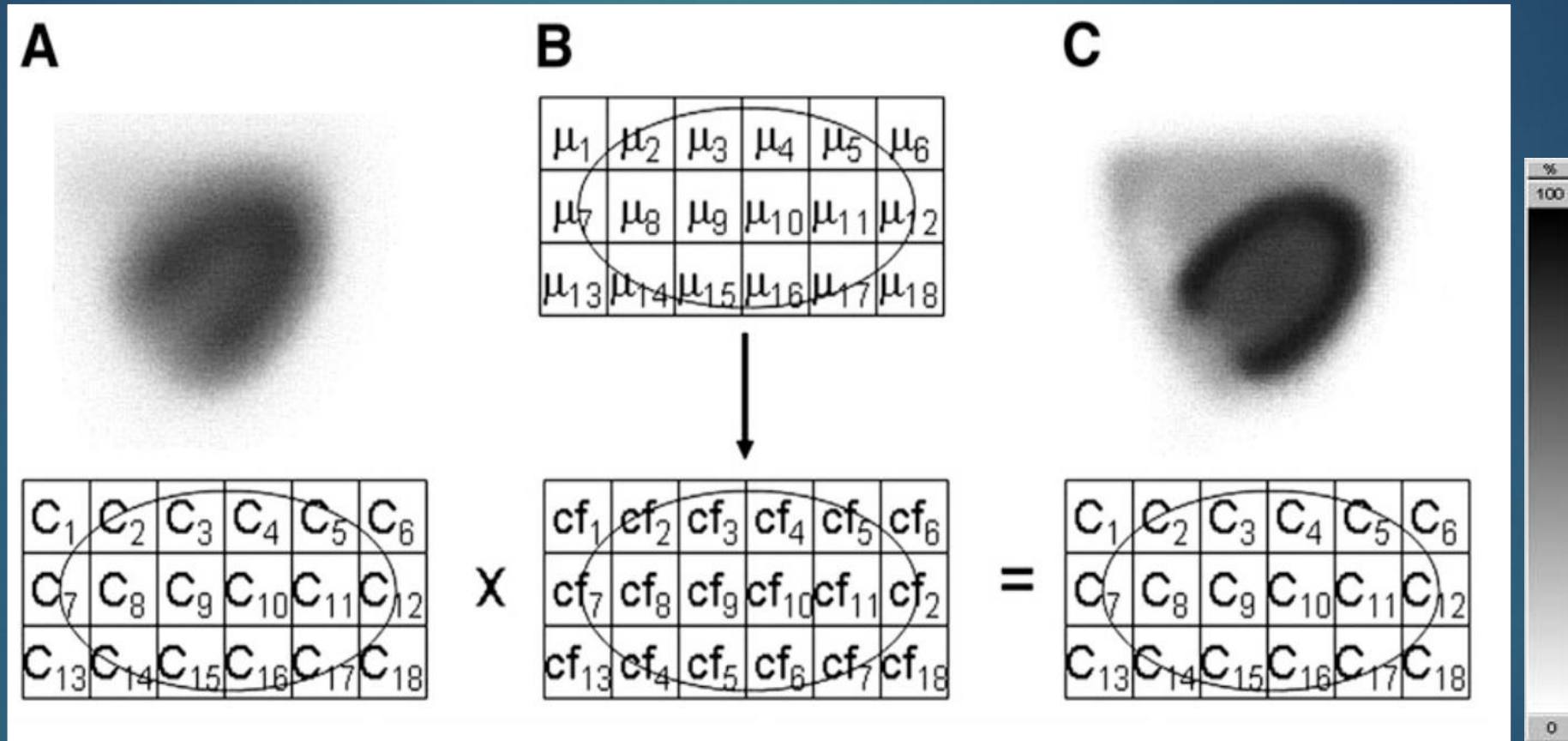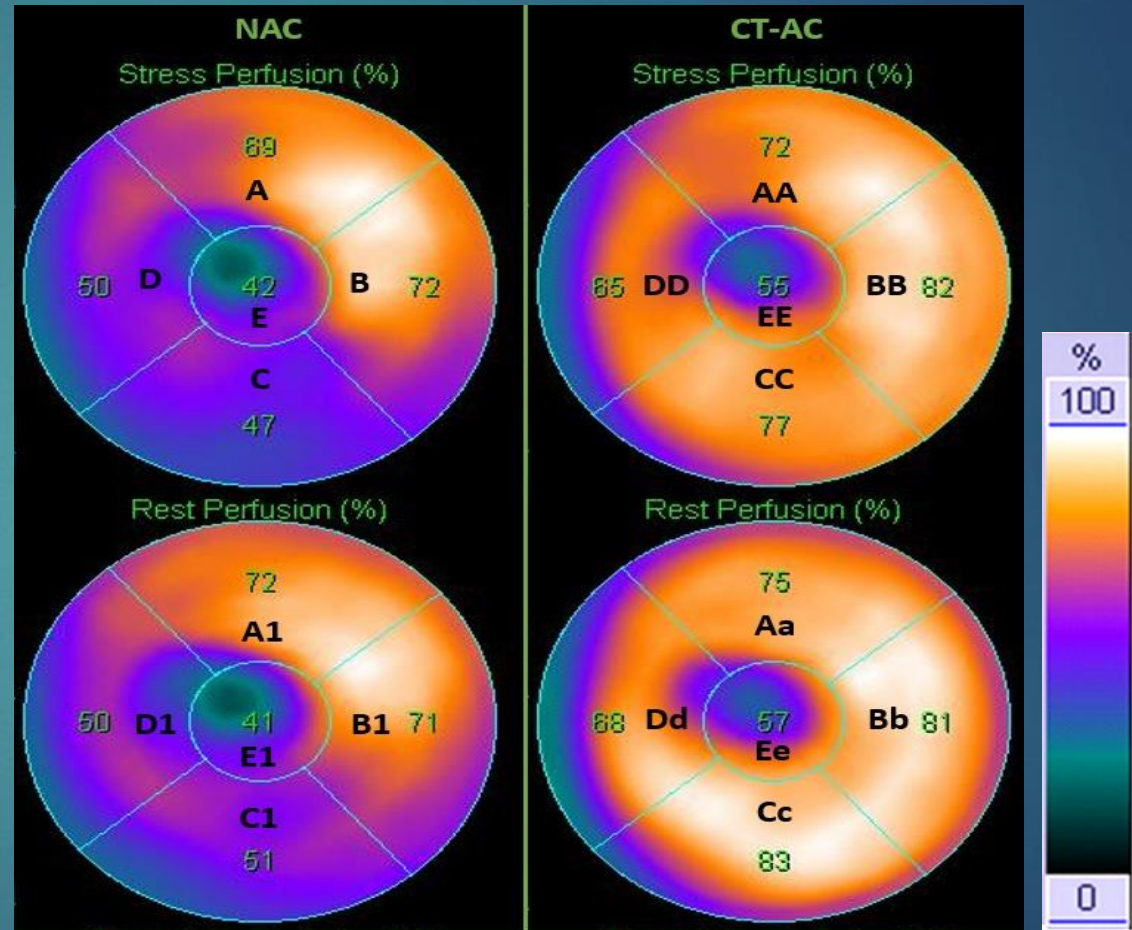
Figure 1 - The AC factors (B) can be obtained from ACOEF measurements determined by CT scan and used to correct emission data from uncorrected SPECT MPI scan (A) to generate AC myocardial images (C) [adapted from 1 and 2].

1   J. A. Patton and T. G. Turkington, "SPECT/CT Physical Principles and Attenuation Correction," *J. Nucl. Med. Technol.*, vol. 36, no. 1, pp. 1–10, Mar. 2008.
2   S. Goetze, T. L. Brown, W. C. Lavely, Z. Zhang, and F. M. Bengel, "Attenuation correction in myocardial perfusion SPECT/CT: effects of misregistration and value of reregistration," *J. Nucl. Med. Off. Publ. Soc. Nucl. Med.*, vol. 48, no. 7, pp. 1090–1095, Jul.   2007.

Figure 2 - By analysing NAC polar maps is obtained a reduced perfusion rate in the INF (C and C1) and SEP (D and D1) LV walls, both for stress and rest respectively. CT systems correct SPECT data and as a result the perfusion rate increases in the affected areas, INF (CC and Cc) and SEP (DD and Dd) LV walls for stress and rest respectively in the CT-AC polar maps.

STUDY POPULATION
MALE 30≤BMI≤35 (M1) N=27
MALE BMI>35 (M2) N=13
FEMALE 30≤BMI≤35 (F1) N=20
FEMALE BMI>35 (F2) N=11

ACQUIRED DATA PROCESSING
Both NON-AC and CT-AC SPECT emission images data were reconstructed by use of Iterative Methods
SPECT emission data were co-registered and fused with CT data
The predetermined attenuation coefficients were applied to SPECT emission data

QUANTITATIVE IMAGE ANALYSIS
Segmentation of left ventricle (LV) into 5 walls : - Anterior (ANT); - Lateral (LAT); - Inferior (INF); - Septal (SEP); - Apical (API).
Quantification of the perfusion percentage of all the walls

STATISTICAL ANALYSIS
Statistical Package for the Social Sciences (SPSS) programme
Friedman test for non-parametrical pared samples (CT-AC and NAC data)

Table 1 - Results of the *p-values* obtained from the perfusion rate comparisons of the LV walls, between AC and NAC SPECT MPI data, on the female study population with BMI between 30 and 35 (F1 group) and above 35 (F2 group).

		FEMALE (F1) 30 ≤ BMI ≤ 35		FEMALE (F2) BMI > 35	
	AC – NAC LV Walls	p - value	AC – NAC LV Walls	p - value
STRESS	ANT	0.240	ANT	0.647
	LAT	**0.006**	LAT	0.073
	INF	**0.000**	**INF**	**0.001**
	SEP	0.076	SEP	0.944
	API	0.240	API	0.504
REST	ANT	0.159	ANT	0.622
	LAT	**0.034**	LAT	0.181
	INF	**0.000**	**INF**	**0.008**
	SEP	**0.044**	SEP	0.833
	API	0.192	API	0.218

- Statistically significant differences between AC and Non-AC results were found in the LAT, INF and SEP (just for REST) walls in the F1 group.

- For F2 group no significant differences were obtained despite the INF LV walls.

- Surprisingly there is no variation in the LAT walls as expected in the F2 group.

Table 2 - Results of the *p-values* obtained from the perfusion rate comparisons of the LV walls, between AC and NAC SPECT MPI data, on the male study population with BMI between 30 and 35 (M1 group) and above 35 (M2 group).

	MEN (M1) 30 ≤ BMI ≤ 35		MEN (M2) BMI > 35	
	AC – NAC LV Walls	p - value	AC – NAC LV Walls	p - value
STRESS	ANT	0.486	ANT	0.348
	LAT	0.000	LAT	0.020
	INF	0.000	INF	0.000
	SEP	0.003	SEP	0.003
	API	0.529	API	0.771
REST	ANT	0.500	ANT	0.627
	LAT	0.000	LAT	0.014
	INF	0.000	INF	0.000
	SEP	0.001	SEP	0.075
	API	0.045	API	0.698

- For male study population, significant changes in LV perfusion between CT-AC and NAC were observed on the LAT, INF, SEP and API (just for REST) walls in the M1 group.

- For M2 LAT and INF regions were affected on STRESS and REST studies. SEP walls only show perfusion variations on the Stress study.

5. Conclusion

- All the member of the staff involved in the acquisition, processing and reporting of SPECT/CT MPI immaging should be aware not only of attenuation artifacts but also of the pitfalls of the CT-AC.

- In the future this study should be continued with a larger study population and adding other parameters such as brassiere size, for females, abdominal perimeter, for males and female, and the quantification of the soft tissues thickness adjacent to the heart in order to correlate the AC and NAC MPI differences with the patients anatomy.

Thank you

E-mail: oleh.stakhiv@bsuh.nhs.uk