DT07

Signal Amplitude Ratio of Magnetocardiogram between Sensor Assembly and Chest Surface

Hyun Kyoon Lim*, Kiwoong Kim, Hyukchan Kwon, and Yong-Ho Lee
Korea Research Institute of Standards and Science, Korea
*Corresponding author: Hyun Kyoon Lim, e-mail: hlim@kriss.re.kr

Magnetocardiography (MCG) using a superconducting quantum interference device (SQUID) sensor has been known as a non-invasive and safe diagnostic tool to detect ischemic heart disease such as angina and myocardial infarction [1]. The magnetic distribution generated by the electrical activation of the heart reveals the abnormality of the myocardiac status [2]. The bust depth of men and women in 20's and 60' are much different, and the greatest gap is up to 154 mm [3]. The purpose of this study is to identify whether MCG signals and parameter values are changed at the different locations of the SQUID sensor assembly. It would be an important reference for the standard measurement. Four male healthy subjects (33.3±6.3 years) participated in this study. The gap between the chest surface and the bottom of the sensor assembly was 20, 40, 60, and 80 mm. Recording was made using 64 channel MCG system (Axial type, first order gradiometer) developed by Korea Research Institute of Standards and Science (KRISS). MCG were recorded for 30 s in magnetically shielded room. As the sensor location is getting away from the chest surface signal, the amplitude of R and T wave peak decreases to 70% (at 40 cm gap), 50% (at 60 mm), and 37% (at 80 mm) of the reference strength measured ($y = 1.3903e^{-0.0169x}$, $R^2 = 0.99$; where y=amplitude remained after reduction, x=distance between chest surface and sensor location). Inter-individual difference was less than 5%. The regression equations may be used as a good reference to calculate how much strength will be decreased by the distance. In MCG parameters, most values of parameters were decreased as the gap was increased. As an example, the current moment at T-wave peak reduced to 52% (at 40 mm gap), 33% (at 60 mm), and 19% (at 80 mm). However, the difference caused by the gap could be reduced by considering the distance when the MCG parameters were calculated. The study results might be used as a useful reference to design the baseline and the sensor location.

Fig. 1. Magnetocardiography system in a magnetically shielded room used in this study.

REFERENCES
[1] R. Fenici, *et al*., Expert Rev Mol Diagn, 5, 291-313 (2005).
[2] H. K. Lim, *et al*., Ann Med, 39, 617-627 (2007).
[3] The 5th Anthropometric Survey of Korea, Ministry of Commerce Industry and Energy, (2004).

DT08

Metocardiogram Difference between Healthy Subjects and Ischemic Heart Disease Patients

Hyun Kyoon Lim[1]*, Namsik Chung[2], Young-Guk Ko[2], Yong-Ho Lee[1], and Yong Ki Park[1]
[1]Korea Research Institute of Standards and Science, Korea
[2]Yonsei University College of Medicine, Korea
*Corresponding author: Hyun Kyoon Lim, e-mail: hlim@kriss.re.kr

Magnetocardiography (MCG) is a device to measure the weak magnetic fields generated from the heart using a superconducting quantum interference device (SQUID) sensor which converts magnetic flux to voltage. In the previous study, authors revealed that the values of MCG parameters of patients with non ST-segment myocardial infarction (NSTEMI) were greater than those of age-matched controls (AMC) [1]. In this study, we selected three different groups of patients considering their severity. We compared 10 MCG parameters recorded from 19 healthy young subjects (26.8±13.4 years), 19 age-matched healthy subjects, 23 stable angina (SA) patients (56.4±7.6 years) with no stenosis (=0% on coronary angiogram) and normal echocardiogram, 24 UA patients (61.9±9.8 years) with severe stenosis (= 70%), and 20 Q-wave myocardial infarction (QMI) patients (57.3±11.2 years) with severe stenosis (≥70%). To record the magnetic signals from a heart with minimal noise, a magnetically shielded room is used. As a result, young healthy subjects showed the smallest values in all 10 MCG parameters and MI subjects showed the greatest values. These results are supportive to the previous analysis. As a result, significant difference was found from dynamics parameters such as current angle, map angle, and distance dynamics between YC and AMC groups ($p<0.05$). No significant difference was found from AMC and SA groups even though parameter values of SA were slightly greater than those of AMC. Significant difference was found from three parameters between AMC and QMI subjects. It is clear that angles of the maximal current and magnetic field map increase when the status of ischemic heart disease patients are getting worse.

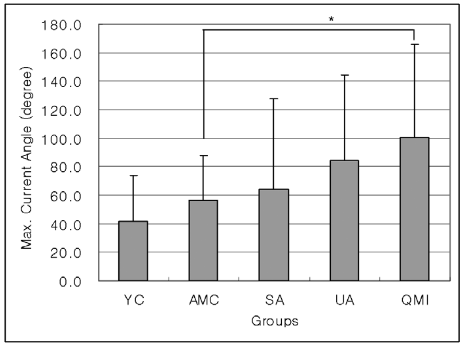

Fig. 1. Maximal current angle for each group.

REFERENCES
[1] H. K. Lim, et al., Ann Med, 39, 617-627 (2007).