Case study for Quipu Cardiovascular Suite

Human Cardiovascular Physiology Laboratory

Faculty of Medicine

Chulalongkorn University

Introduction

Our interest includes a broad range of research topics in physiology and pathophysiologic involvement in cardiovascular diseases as well as the interplays between risk factors on disease development and progression. Our research involves healthy individuals and many clinical populations.

Research

We are establishing a testing protocol and adjusting the necessary techniques of endothelial function measurement using a high-resolution ultrasound scanner for our lab. We are simultaneously running a pilot study on vascular function in subjects at risk of hypertension. Under the scope of this study, we would like to determine the functional role of various lifestyle factors and genetic inheritance on vascular function. We try to identify physiologic characteristics possibly unique to individuals at risk of
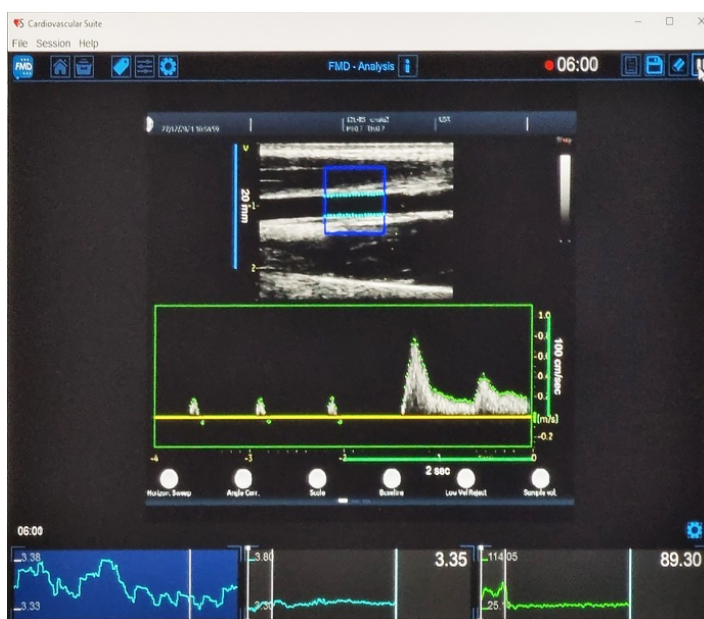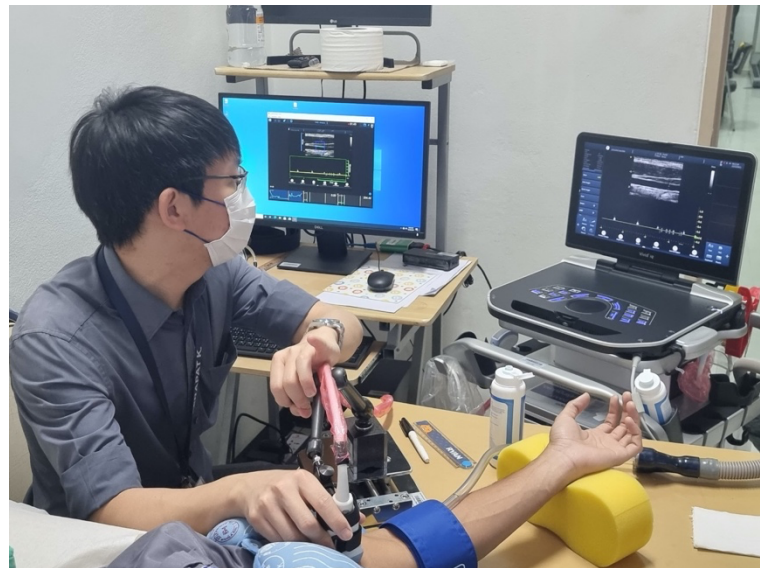
developing hypertension. In this pilot study, we asked a simple question on whether young healthy individuals with parental history of hypertension (PHx+ve) would respond to sugar consumption differently from those who do not have a parental history of hypertension (PHx-ve). This would provide an insight on pathophysiology contributing to the development of hypertension in the context of genetic-environment interaction. To accomplish our research aim we use available vascular function tests including flow-mediated dilation by ultrasound assessment with aid of user-friendly edge detection and wall tracking software.

Challenge

During this period of the COVID-19 situation, we encounter many challenges. All activities including research plans have been greatly retarded or even paused. People have been asked not to move around much. After receiving ethical approval from the local IRB, we were able to collect a small number of subjects to determine the effect of table sugar on vascular function in young healthy subjects at risk of hypertension due to medical history of parental hypertension. Regarding the test itself, the great challenge would be the difficulty to persistently get good scans of the brachial artery and maintain the clear wall image throughout the measurement period.

Flow Mediated Dilation

Shear rate maximum

Findings

Due to a small number of subjects able to make the appointment, we could only complete 10 visits of 6 volunteers. Subjects reported to the lab after an overnight fast. After establishing the baseline endothelial function, the subjects would have 60-gram sucrose ingestion on one visit or water ingestion on a control visit. Flow-mediated dilation (FMD) was determined again after each ingestion at 60 and 120 minutes. The initial results (figures provided) may not be able to interpret. However, the information on brachial diameter values suggested that our laboratory techniques values obtained by software determination were relatively stable.

Conclusion

The initial data suggested a tendency of diverse responses of FMD to table sugar consumption at various time points of the two groups. More data are needed before we can make a firm conclusion for this research question. With the aid of analysis by the appropriate vascular software, the burden of video analysis becomes easily handled in a short time. The use of real-time analysis gives immediate feedback on the quality of the image and cumulatively saves a substantial amount of time to spend in offline analysis.

Benefit

Using edge detection and wall-tracking software for brachial diameter and FMD analyses minimizes bias and errors from manual measurement. Many indexes obtained from the imaging analysis are potentially useful for vascular biological markers. Understanding disease
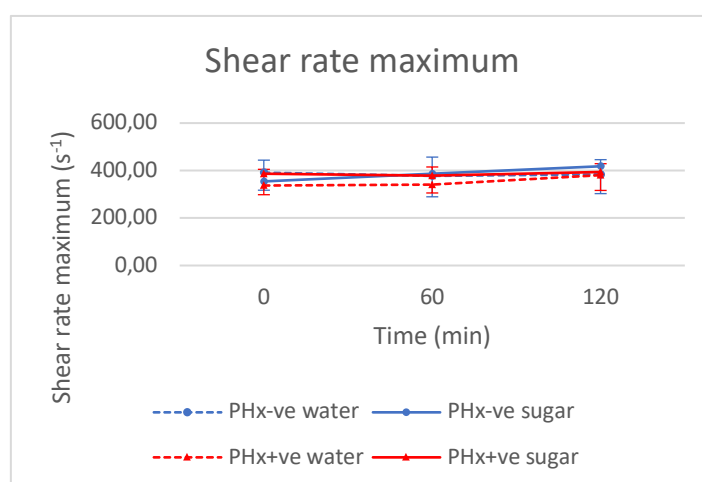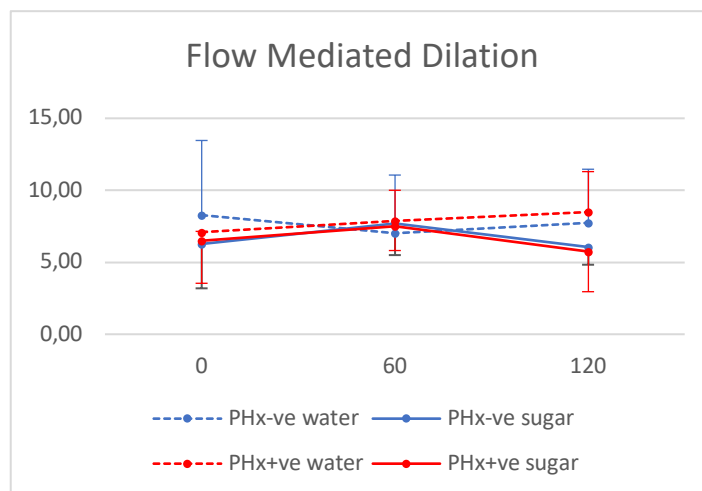
pathophysiology and its development will shed some light on the prevention and treatment of the diseases.

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