Can imaging of improve our understanding of cardiovascular disease?

The development of new ways for imaging the heart has contributed significantly to our understanding of cardiovascular disease. Combined positron emission tomography and computed tomography (PET-CT) allows us to visualize in great detail the anatomy of the heart and blood vessels whilst simultaneously measuring disease activity within these structures. Radioactive PET tracers targeted to a specific disease process are injected in to a patient. These tracers then accumulate in areas of the body where that process is occurring, providing a map of disease activity within the body. When PET is combined with traditional anatomical imaging techniques such as CT, we can obtain information regarding anatomy and structure (CT) alongside disease activity (PET) in a single scan. This powerful combination can provide important insights in to the mechanisms causing disease. Indeed, a number of recent research studies have used PET-CT to assess atherosclerosis (the condition leading to heart attacks and strokes), improving our understanding of why some people are more at risk than others of heart attack and stroke.

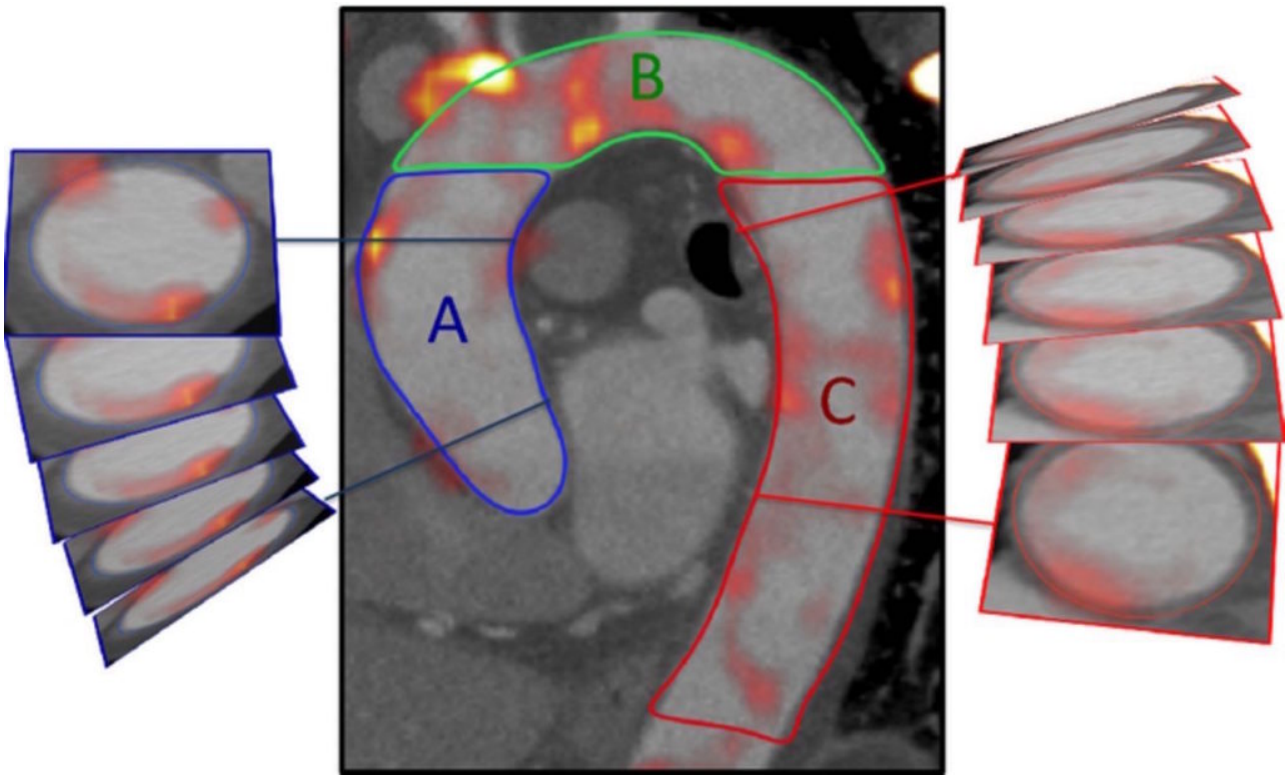

Fig. 1. Measurement of FDG radiotracer uptake in the aorta.

Obesity is a serious and rapidly growing health concern throughout the world. One of the major

risks associated with obesity is the accelerated progression of atherosclerosis and the increased risk of heart attacks and strokes. Recently, our understanding of the risks associated with excess body fat has evolved and it is now believed this fat might play a direct and active role in the development of atherosclerosis by releasing a number of mediators that cause inflammation within blood vessels.

Recently, a study of over 400 patients sought to assess the relationship between the volume of fat tissue surrounding internal organs (visceral fat) and inflammation of blood vessels. The aim was to determine whether an increased volume of visceral fat is related to both arterial inflammation and future cardiovascular events. For this purpose, the authors used PET-CT to measure the volume of adipose tissue within the abdominal cavity and simultaneously measure inflammation within the large blood vessels and within the fat tissue itself. They demonstrated that patients with a combination of elevated visceral fat volume and vascular inflammation are at greater risk of future heart attacks and stroke. Conversely, traditional measurement of body fat such as the body mass index (BMI) did not effectively predict events. Thus, individuals who are prone to store fat around organs (visceral fat) rather than peripherally appear to be at a greater risk; an observation that questions whether we should be using BMI measurements to assess our patients.

Importantly, this trial also adds to growing evidence that the detection of vascular inflammation using PET appears to identify patients at increased cardiovascular risk. Furthermore, the results suggest that there may be an association between vascular inflammation and the volume of visceral fat, provoking further speculation that fat tissue may actively promote cardiovascular disease. However, a limitation of this and similar observational imaging studies is that they can only establish an association, and are unable to determine causality. Further work is therefore required to assess whether visceral fat directly contributes to vascular inflammation, perhaps by assessing the effect of dramatic weight reduction (e.g. gastric banding surgery) or weight gain on the PET signal. Moreover, this study was conducted in patients suspected of having cancer, a specific patient group that may not be fully representative of the wider patient population. Nonetheless, this study, alongside a number of other recent trials, has demonstrated the great potential of non-invasive cardiac imaging to develop theories and enhance our understanding of cardiovascular pathophysiology. With the evolution of advanced techniques, reduced radiation doses and lower costs, advanced imaging of the heart and blood vessels will continue to advance our understanding of cardiovascular disease, with the hope that this will translate in to improved care for our cardiovascular patients.

Mhairi K. Doris, Marc R. Dweck
Centre for Cardiovascular Science,
University of Edinburgh, Edinburgh, Scotland, United Kingdom

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