

BY KATHARINA MIEDZINSKA



From the pericardium to cardiac veins: often forgotten cardiac structures

Imaging the heart is a complex matter, not least because of its perpetual motion and the small size of some of the structures that need to be evaluated. However, despite these and other challenges, imaging of the heart has advanced massively in recent years, today playing a central role in the recognition, characterisation, monitoring, and successful treatment of a wide range of cardiac diseases. Chief among them is, of course, cardiovascular disease, the most common cause of death worldwide and thus, an important focus for cardiac imaging ... but sometimes at the cost of other structures.

Cardiac imaging techniques tend to focus on the left ventricle, coronary arteries and cardiac valves, particularly in the adult patient. This reflects the prevalence and significance of diseases affecting these structures in the general population, according to Dr. Charles Peebles, from the department of cardiothoracic radiology at the University Hospital Southampton, UK, who will chair today's session.

It is therefore possible that other areas of anatomy are overlooked or overshadowed, even though anomalies of these structures may be the cause of significant pathology and lead to a broad range of difficulties in cardiovascular interventional procedures. In today's session, four experts will bring some of these structures back into the spotlight.

"The session will focus on areas of anatomy and their functional significance, that are often forgotten in the primary cardiac analysis," said Peebles, who expects the session to offer delegates comprehensive knowledge of often forgotten, but no less important cardiac structures, and imaging techniques available to evaluate them.

Starting the session off will be Dr. Alain Nchimi Longang, from the department of medical imaging at the Centre Hospitalier de Luxembourg, who will familiarise ECR delegates with pericardial diseases, which encompass a wide spectrum of clinical conditions. According to Nchimi Longang, delayed diagnosis and inappropriate management of these conditions are associated with high morbidity and mortality, whereas appropriate treatment

may dramatically relieve patient symptoms.

In his presentation, he plans to specifically address the basic spectrum of disease processes affecting the pericardium, physiological effects of pericardial disease on cardiac function, the definition of pericardial syndromes, and the specific advantages and weaknesses of CT and MRI in evaluating pericardial diseases and differentiating normal from abnormal findings.

Following his presentation, Dr. Gorka Bastarrika, from the department of radiology at the University Clinic of Navarra, Pamplona, Spain, will discuss the right ventricle (RV), focusing especially on normal appearances of the right ventricle on CT and MRI, appearances and physiology of RV volume and pressure loading, and adverse prognostic markers related to the RV.

However, the pericardium and the right ventricle are not the only often forgotten structures; epicardial fat also joins the list. "For radiologists, knowledge about epicardial fat is of vital importance and with non-invasive imaging it is not only possible to measure it precisely, but also to reveal its role in cardiovascular disease," said Assoc. Prof. Dr. Katarzyna Gruszczyńska, from the department of radiology and nuclear medicine at the Medical University of Silesia, Katowice, Poland. Her talk will address the differences between epicardial and pericardial fat and methods of quantifying epicardial fat. She will also try to answer the question of whether epicardial fat should be

seen as a friend or an enemy of the cardiovascular system.

"Epicardial and pericardial fat are both localised in the mediastinum, around the heart, with epicardial fat tissue (EFT) being the layer of adipose tissue located within the visceral pericardium directly on the myocardium, covering the coronary vessels, and pericardial fat being located outside the parietal pericardium," she explained, emphasising that EFT is the metabolically active visceral fat. "It is responsible for myocardial energy supply, lipid-storage, thermoregulation, and endocrine secretion. There has been growing interest among researchers in EFT recently, as cardiovascular disease remains the main cause of death in the developed world and as there is also a relationship between EFT and cardiovascular risk factors such as obesity, metabolic syndrome, hypercholesterolemia, and coronary atherosclerosis burden. In many studies, patients with a high increased calcium score also have a high amount of EFT. So EFT can act as both a friend and an enemy of our cardiovascular system."

Meanwhile, studies suggest that EFT can act as an independent predictor of cardiovascular risk and adverse coronary events. "Currently available data for pericardial fat are rather vague. Due to its close relationship with the heart and coronaries, EFT seems to be more interesting for researchers," Gruszczyńska said, adding that traditionally, EFT thickness has been measured by ECHO.

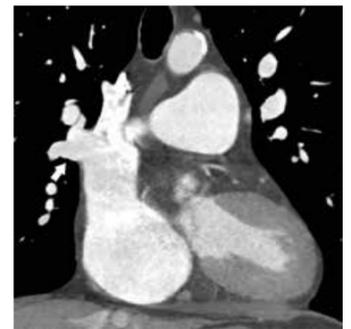
"However, CT and MRI offer the possibility of non-invasive quantification of EFT, and the dedicated software already exists. Although EFT is subject to research in diagnostic imaging, it is also useful to recognise its anatomical variants, as they could mimic disease."

During her talk, Gruszczyńska will discuss both methods, as well as their strengths and weak points. "I personally used cardiac MRI to measure EFT on short-axis slices; however, CT offers better spatial resolution and is very fast. It is important to accurately compare these different methods and programmes and to validate them against manual measurement. Standardisation is the key to being able to use EFT measurement as an endpoint in clinical studies."

Last but not least, Dr. Maja Hrabak Paar, from the department of



CT angiography of the coronary sinus in a patient with persistent left superior vena cava draining into coronary sinus and agenesis of the right superior vena cava performed for planning of left ventricular lead placement in cardiac resynchronisation therapy. Right ventricular lead has already been inserted. (Provided by Dr. Maja Hrabak Paar)



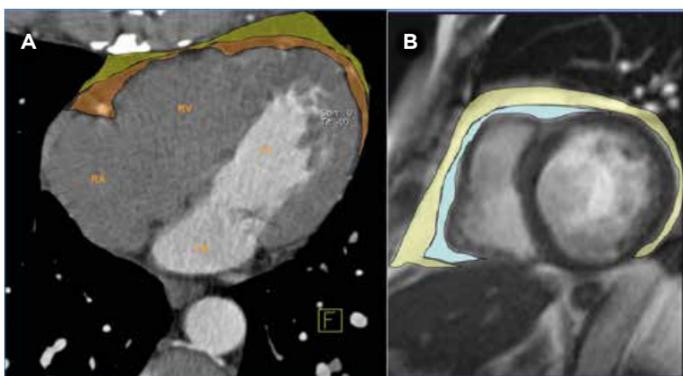
Partial anomalous venous return of the right superior pulmonary vein (arrow) into the superior vena cava.

one or more pulmonary veins does or do not drain into the left atrium, but to the right atrium or venae cavae. Oxygenated blood is returning to the right side of the heart, causing left-to-right shunting and volume overload of the right heart. The shunting can be even more relevant if this anomaly is associated with a special type of atrial septal defect called 'sinus venosus atrial septal defect', which is located close to the entrances of the superior and inferior vena cava to the right atrium and can be difficult to detect with echocardiography."

During her talk, Hrabak Paar plans to familiarise ECR delegates with the normal anatomy of pulmonary, systemic, and coronary venous drainage and to go over related common anomalies and their clinical significance point-by-point. "Understanding of venous anomalies is essential for their optimal interpretation and for the avoidance of diagnostic pitfalls," Hrabak Paar concluded.

diagnostic and interventional radiology at the University Hospital Center Zagreb, Croatia, will discuss anomalies of cardiac veins and venae cavae, another important issue in the context of often forgotten cardiac structures.

"When radiologists analyse cardiac examinations, they usually focus on arterial structures, while venous structures are often forgotten, although their anomalies can lead to relevant shunts or cause difficulties in cardiovascular interventional procedures," she said. Hrabak Paar uses the example of partial anomalous pulmonary venous return to illustrate her point: "In this anomaly,



Two modalities used by radiologists to measure epicardial fat. A: Axial CT image, epicardial fat (orange) lying directly on the myocardium, pericardial fat (yellow) localised outside the pericardium. B: Cardiac MRI, short-axis view, epicardial fat in blue, pericardial fat in yellow. (Provided by Dr. Katarzyna Gruszczyńska)

State of the Art Symposium

Saturday, March 2, 08:30–10:00, Room F2
SA 13 Cardiac: recalling the forgotten structures

- » Chairperson's introduction
C. Peebles; Southampton/UK
- » Hide and seek: the pericardium
A. Nchimi Longang; Luxemburg/LU
- » Lost chamber: the right ventricle
G. Bastarrika; Pamplona/ES
- » Friend or enemy: epicardial fat
K. Gruszczyńska; Katowice/PL
- » Wrong ways: anomalies of cardiac veins and venae cavae
M. Hrabak Paar; Zagreb/HR
- » Panel discussion: Which test would you use, MRI or CT?