Rev Esp Med Legal. 2018;44(1):22–31

ASOCIACIÓN NACIONAL DE MÉDICOS FORENSES

Spanish Journal of Legal Medicine
Revista Española de Medicina Legal

www.elsevier.es/mlegal

REVIEW

Post-mortem diagnoses of structural cardiopathies☆

Beatriz Aguilera Tapia, María Paz Suárez Mier*

Servicio de Histopatología, Instituto Nacional de Toxicología y Ciencias Forenses, Las Rozas, Madrid, Spain

Received 19 June 2017; accepted 21 June 2017
Available online 13 February 2018

KEYWORDS
Sudden cardiac death;
Coronary artery disease;
Cardiomyopathies;
Heart valves;
Pathology

Abstract Cardiac diseases are responsible for 80% of sudden deaths, but they may also be involved in deaths that have occurred during surgical procedures or in hospitalised patients, as well as being related to accidental deaths. A specialised heart examination guarantees the medico-legal assessment of the cause of death, and is essential in the diagnoses of familial cardiopathies. The pathological characteristics, according to cardiovascular pathology criteria of the most frequent structural cardiopathies in forensic practice are presented.

PALABRAS CLAVE
Muerte súbita cardiaca;
Enfermedad coronaria;
Miocardiopatías;
Válvulas cardiacas;
Patología

Diagnóstico *post mortem* de las cardiopatías estructurales

Resumen La patología cardiaca no solo es responsable del 80% de las muertes súbitas, sino que puede ser coadyuvante en las muertes ocurridas durante intervenciones quirúrgicas o en el transcurso de ingresos hospitalarios, y puede estar relacionada con muertes accidentales. Un estudio especializado y protocolizado del corazón garantiza una correcta valoración médico-legal del fallecimiento, pero además es esencial para la detección de cardiopatías familiares. Se presentan las características anatomopatológicas de las cardiopatías estructurales más frecuentes en el ámbito forense según criterios de los grupos de referencia en patología cardiovascular.

DOI of original article: http://dx.doi.org/10.1016/j.reml.2017.06.006
☆ Please cite this article as: Aguilera Tapia B, Suárez Mier MP. Diagnóstico *post mortem* de las cardiopatías estructurales. Rev Esp Med Legal. 2018;44:22–31.
* Corresponding author.
E-mail address: mariapaz.suarez@justicia.es (M.P. Suárez Mier).

Introduction

Heart disease is not only responsible for 80% of sudden deaths (SDs), but may also be involved in deaths that have occurred during surgical procedures or hospital admissions, and may be related to road traffic accidents, or accidents which have occurred at work or at home. Likewise, death may be as a result of complications associated with interventions on the cardiovascular system, such as corrections of congenital heart disease, coronary intervention, ablations, valve replacement, pacemaker placement, etc.[1] Due to all of these circumstances, the histopathological study of the heart is the most requested study in the judicial field. A specialised and standardised study of the heart guarantees the correct medico-legal assessment of the death, but it is also essential for the detection of inherited heart diseases.

Cardiovascular autopsy

There are several publications concerning cardiovascular autopsy.[1,2] One of the most important publications is that issued by the Association for European Cardiovascular Pathology,[3] the update of which will be published in the next few weeks. The diagnostic criteria of the different heart diseases, such as cause of death, which is extremely important regarding implications for family members, are listed in these guidelines and other studies.[4]

Although it is not always accessible to the medical examiner, clinical information is essential to appropriately guide the heart study: personal cardiac history (syncopal episodes, chest pain, HTN, implantation of coronary stents or valve replacements, etc.) and extracardiac history, as well as family history of heart disease. Due to the fact that numerous heart diseases are inherited, the sampling of blood (in EDTA) and of fresh tissue is essential for genetic studies.[3]

The study of the heart starts with the opening up of the rib cage to rule out haemothorax or haemomediastinum which may be secondary to rupture of the thoracic aorta. The contents of the pericardial sac, both its volume and characteristics, are then studied. Haemopericardium should make us consider a rupture of the ascending aorta or ruptured acute myocardial infarction (AMI). With the heart in situ, the pulmonary trunk should be sectioned looking for thrombi which may have lodged into both pulmonary arteries. The heart is completely dissected with both atria intact. Normal heart weight is not an absolute value but, rather, depends on body weight and height. Reference tables therefore have to be used.[1,5] It is advisable to perform an X-ray of the entire heart to locate coronary stents and assess prostheses. Please refer to Morentin et al.[2] for a thorough description of the heart study method. We will now move on to discuss the most common diseases.

Coronary artery disease

This is the most common heart disease in forensic practice given that 60–90% of SDs are attributed to this disease. We found ischaemic heart disease, predominantly chronic, both of the coronary arteries (with stenosis >75% of the lumen) (92%), and of the myocardium (scars) (39%) in 65% of the SDs studied in our department.[6] The chronic stenotic lesions of the coronary arteries are divided into two large groups: stable plaques with thick fibrous capsules on a lipid or fibrous necrotic centre (atheromatous plaques themselves) or pathological intimal hyperplasia (juvenile atherosclerosis).[7] The incidence of acute coronary thrombosis is variable (we found it in 27% of cases),[6] and it can be caused by the rupture of atheromatous plaques with thin fibrous capsules (vulnerable plaques) which result in the content of the plaque being excreted and intraluminal fibrin-platelet thrombosis (Fig. 1A); or to endothelial denudation of the plaque (erosion) with occlusive or mural platelet thrombosis (Fig. 1B); this type occurs in stable atheromatous plaques or in pathological intimal hyperplasia. Plaque rupture occurs more frequently in males aged 35–80 with classic risk factors (hyperlipidaemia, smoking, diabetes) and erosion occurs more frequently in younger people associated with smoking and genetic factors.[7] The link between cocaine use and early atheromatosis with coronary thrombosis is important in young people.[8,9]

Coronary thrombosis causes AMI but, when death occurs at an early stage (in less than 12 h) from the coronary occlusion, there is no time for the ischaemic necrosis in the myocardium to be visible. The dating of the AMI is a very important issue in forensic pathology, because the deceased frequently present with symptoms hours before death for which medical attention is requested. Table 1 summarises the chronology of an infarction adapted from Schoen[10] (Fig. 1C–F).

Non-atherosclerotic coronary artery disease

Congenital abnormalities originating in the coronary arteries account for the second biggest cause of SD in competitive American athletes,[11] and for 2–4% of SDs in recreational athletes in our setting.[12] Several types can be found: origin of the left coronary artery in the pulmonary trunk or in the right coronary sinus (Fig. 1G); origin of the right coronary artery in the left sinus; or origin of either of the two several mm above the sinotubular junction.[13] The origin of the left coronary artery in the pulmonary artery trunk results in the left ventricle (LV) receiving poorly-oxygenated blood, which induces the development of collateral branches from the right coronary artery to compensate for hypoxia but, in situations of greater oxygen demand, such as sporting activity, it can cause SD.[6,12] The consequences of the coronary artery originating from the opposite sinus depend on the acute angle of the ostium and its path from its origin to being located in its normal position. The acute angle and the course of the anomalous coronary artery between the aorta and the pulmonary artery, or embedded in the aortic wall, makes them susceptible to collapsing during physical exercise.

The *intramyocardial course* of the anterior descending coronary artery is a very common finding, reported in 21% of autopsied hearts. It is considered to be of greater importance when it has a length of 2–3 cm, a depth of 2–5 mm, the surrounding myocardium is arranged in the form of a sphincter around the coronary artery and there is fibrosis.[13,14]