

Arrhythmogenic Right Ventricular Cardiomyopathy: a case report

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Abstract

Arrhythmogenic right ventricular cardiomyopathy (ARVC) is a myocardial disease, often familial, characterized pathologically by fibrofatty replacement of the right ventricular myocardium, resulting in thinning of the ventricle. ARVC is an important cause of sudden death in individuals less than 30 years of age and has been found in up to 20% of sudden deaths in young people. A 21-year-old male collapsed to the ground while playing with his friends for about 10 minutes time. There was no history of trauma prior to the collapse. He had a mild upper respiratory tract infection three days prior, however he was not on any medication at the time of this incident. He was immediately taken to the nearby hospital where he was found to be in cardiac arrest. Post-mortem examination revealed an enlarged heart (heart weight 545 g). The right ventricular wall thickness was 6 mm. Coronary arteries were normal in configuration with a left dominant circulation. The right and left coronary ostiae were patent. Coronaries were free from atherosclerotic narrowing. Sections from the right ventricular myocardium showed variable, predominantly epicardial fibrosis throughout and transmural infiltration of adipocytes. The cardiomyocytes in these areas showed patchy vacuolation and nuclear hypertrophy. The remaining myocardium was mainly unremarkable. These findings were in keeping with arrhythmogenic right ventricular cardiomyopathy. The importance of a thorough knowledge on specific cardiac conditions that can lead to sudden death and the importance in thorough sampling of cardiac muscle in such cases is highlighted here.

Keywords: ARVC, Sudden cardiac death, Right ventricular hypertrophy

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Introduction

Arrhythmogenic right ventricular cardiomyopathy (ARVC) is a myocardial disease, often familial, that is characterized pathologically by fibrofatty replacement of the right ventricular myocardium, resulting in thinning of the ventricle.^[1,2,3,4] The fibrofatty replacement interferes with electrical impulse conduction and is the key cause of main clinical features of ARVC including ventricular fibrillation, ventricular extra-systoles, supraventricular tachycardias, right ventricular failure and sudden death.^[3]

During the recent past, ARVC has been identified as a main cause of sudden death among young athletes. According to literature, ARVC is an important cause of sudden death in individuals less than 30 years of age and has been found in up to 20% of sudden deaths in young people. [1,4] ARVC is considered to have an autosomal dominant pattern of inheritance. However, the molecular defects and the susceptible genes are yet to be identified.^[4] It has been linked to a gene located in chromosomes 14q,

23q, and 24q.^[5,6] The presence of inflammatory cells in some cases may indicate involvement of some viral infections. The estimated prevalence of the disease in the general population ranges from 1 in 1000 to 1 in 5000.^[7,8,9]

Even though the classical disease phenotype of ARVC is characterized by early and predominant right ventricular involvement with no or mild left ventricular disease, some of the recent studies based on autopsy investigation, genotype-phenotype correlations, and cardiac magnetic resonance have shown that the left ventricular involvement is common, often occurs earlier than initially thought.^[10] Because of this increasing identification of biventricular and left dominant variants, some authors prefer to categorize ARVC under Arrhythmogenic cardiomyopathies.^[11]

Case report

A 21-year-old male collapsed to the ground while playing with his friends for about 10 minutes time. There was no history of trauma prior to the collapse.

He had a mild upper respiratory tract infection three days prior, however he was not on any medication at the time of this incident. No other significant past medical history was present and he was not on regular medications. He was immediately taken to the nearest hospital where he was found to be in cardiac arrest. Although resuscitation and emergency management were performed, his condition gradually deteriorated and he was pronounced dead approximately 20 minutes after admission. After an inquest, an autopsy was requested by the inquirer into death.

Autopsy was performed on the body of an adult male, weighing 76 kilograms and measuring approximately 176 cm in height with a body mass index of 25 kg/m². No injuries were seen on external examination. An endotracheal tube was in-situ with intravenous canulae on the dorsum of both hands.

There was 40 ml of serous fluid in the pericardial cavity. The heart weighed 545 g. The right ventricular cavity diameter measured 45 mm. The right ventricular wall thickness was 6 mm. The left ventricular cavity diameter measured 35 mm and the left ventricular free wall thickness was 15 mm. The interventricular septum measured 15 mm in thickness and was intact. The chordae were unremarkable. The cardiac valves were normal in configuration. Coronary arteries were normal in configuration with a left dominant circulation. The right and left coronary ostiae were patent. Coronaries were free from atherosclerotic narrowing. The aorta showed a smooth intima. All ostia were widely patent. There was no evidence of aortic dissection or aneurysm formation. The carotid arteries examined up to the bifurcation were devoid of significant stenosis. There was approximately 200 ml of serous fluid within the right pleural cavity and 100 ml within the left. No adhesions were seen. Both lungs were congested but areas of collapse, consolidation or mass lesions were not seen. There was no evidence of thromboembolism. The brain was normal in configuration. Serial coronal sections through the cerebral hemispheres did not show any abnormality of the cerebral cortex, underlying white matter or basal ganglia. The liver weighed 1211 g with an intact capsule. The parenchyma was unremarkable. The left kidney weighed 216 g. and the right kidney weighed 196 g. Both renal capsules were easily removed to reveal smooth cortices. The cortices were of normal thickness, with good cortico-medullary definition. The renal pelvis and ureters were unremarkable and unobstructed. The spleen weighed 278 g and was macroscopically unremarkable.

Histological examination of the right ventricular myocardium (Figure 1, Figure 2, Figure 3) showed

variable, predominantly epicardial fibrosis and transmural adipocyte infiltration of the myocardium.

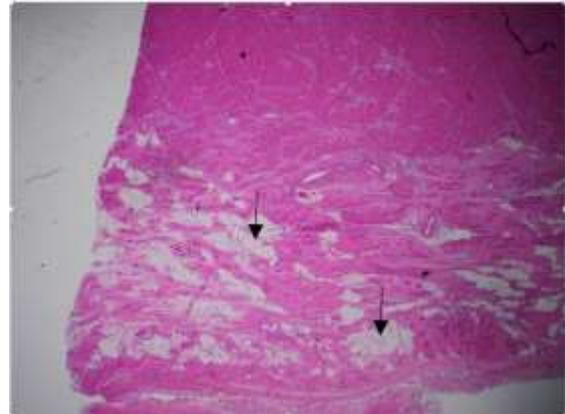


Figure 1 –Fibrosis and fatty infiltration of the right ventricle – H & E stain Low power x 10

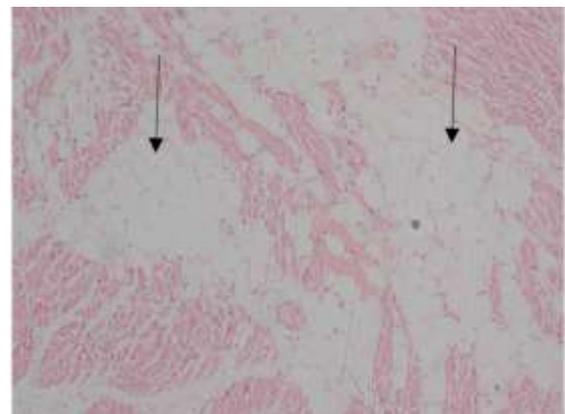


Figure 2 - Fibrosis and fatty infiltration of the right ventricle – medium power x 20

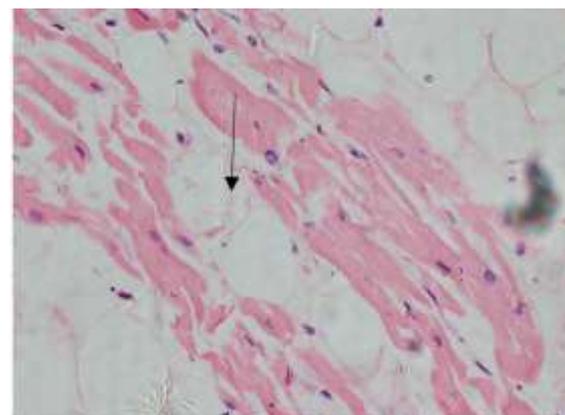


Figure 3 - fibrosis and fatty infiltration of the right ventricle – high power x 40

The cardiomyocytes in these areas showed patchy vacuolation and nuclear hypertrophy. The remaining myocardium was mainly unremarkable. Sections of coronary arteries showed up to 20% eccentric, non-calcified atheroma, mainly in the left anterior descending coronary artery. There was no

evidence of thrombus in the submitted sections. A significant inflammatory infiltrate was not seen. Histology of other organs were unremarkable. These findings were in keeping with arrhythmogenic right ventricular cardiomyopathy.

Discussion

Clinical diagnosis of ARVC sometimes may not be possible, mainly because they are asymptomatic until the first presentation with cardiac arrest. Conventional non-invasive methods may not be adequate in the diagnosis of some other cases.^[12] Around 90% of the patients may show ECG abnormalities with the most frequent one been the T wave inversion in the precordial leads (V1 – V3).^[13] The most common presentation of the ARVC is, as in this case, young patients presenting with ventricular arrhythmias after physical exertion. Related symptoms may include syncope and palpitation; however, some may not show any symptom at all.^[14] Non-specific clinical features often consist of an infarct-like picture with chest pain, release of myocardial enzymes, and normal coronary arteries.^[15] The ventricular arrhythmias can range from isolated premature ventricular beats to sustained ventricular tachycardia (VT) with an LBBB morphology, or ventricular fibrillation (VF) leading to sudden cardiac arrest.

A definitive diagnosis of ARVC can only be made with the characteristic histological findings of the myocardial sample taken at the autopsy or the endomyocardial biopsy taken in the living subject. The most important histopathological finding of ARVC includes the diffuse or segmental loss of the right ventricular free wall and its replacement by fibrofatty tissue.^[16] Progressive fibrofatty replacement of the right ventricle wall usually begins from the epicardium and later extends to the myocardium with transmural infiltration of adipocytes. This can finally lead to thinning and aneurysm formation typically found at inferior, apical and infundibular walls. In this case thinning of the right ventricular wall was not observed. As the myocardial atrophy and progressive thinning takes time, this patient might have died in the early stages of the disease.

Fatty infiltration of the right ventricle alone is not considered a sufficient morphological hallmark of ARVC.^[3] As presence of small amounts of intramyocardial fat in the right ventricle, especially in the antero-lateral and apical region, is considered normal, substantial fat replacement with fibrosis with degenerative changes of the myocytes are essential to make a definitive diagnosis.^[17]

Because of the segmental involvement of the right ventricular free wall, and rare involvement of the interventricular septum, histopathology diagnosis

may be challenging.^[12] Accurate sampling techniques are required in every suspected case to successfully identify this disease and a thorough understanding of the disease and the histopathological changes are essential in the diagnosis of ARVC.

Conclusions

ARVC is a disease of heart muscle thought to be related to dysfunction of specific cardiac proteins (desmosomes). This change predisposes to the development of cardiac arrhythmias, which, as in this case, can result in sudden death, particularly after exertion. Sudden death may be the first presentation of the disease. The importance of considering all the diseases that commonly cause sudden cardiac death and the importance of through sampling of the heart muscle in all such cases is highlighted in this case report.

Disclosure statement

Conflicts of interests: The authors declare that they have no conflicts of interests.

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