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A REVIEW ARTICLE ON RARE HEART DISEASE "RESTRICTIVECARDIOMYOPATHY"

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ABSTRACT

Restrictive cardiomyopathy is a rare form of cardiomyopathy characterized by abnormal stiffness of the heart muscle, resulting in reduced perfusion, and decreased cardiac output. This review article provides a comprehensive overview of the pathophysiology, clinical presentation, diagnostic approach, and treatment of restrictive cardiomyopathy. This article also discusses the various underlying causes of restrictive cardiomyopathy, including genetic mutations, invasive disorders, and hypotonic diseases, as well as potential complications and prognostic factors associated with this disorder. In addition, this article highlights the importance of a multidisciplinary approach to the care of patients with restrictive cardiomyopathy that includes cardiologists, hematologists, geneticists, and other specialists. Overall, this review article serves as a valuable resource for clinicians, researchers, and healthcare professionals involved in the diagnosis and management of restrictive cardiomyopathy.

INTRODUCTION

Restrictive cardiomyopathy (RCM) is a fatal but rare disease that is mainly caused by infiltrates and some genetic disorders. In general, genetic RCM is characterized by a near-normal-sized left ventricle with increased stiffness and dilated atria due to increased ventricular end-diastolic pressure. This disease is called a diastolic disorder because it is associated with an abnormal loading pattern. Systolic function is near normal, at least in the early stages of the disease, but may be impaired in the later stages of the disease. Mild hypertrophy is sometimes observed, making the diagnostic distinction between RCM and HCM difficult. [1] The most common cause of invasive disease is amyloidosis, which results from the misfolding and deposition of proteins (amyloid) between muscle fibers or in the walls of coronary arteries. Amyloid causes the wall of the heart to enlarge, causing hypertrophy. However, muscle fibers themselves are not affected in HCM. [2] There are two main types: light chain amyloidosis (AL) and transthyretin amyloidosis (ATTR). The latter type includes wild-type ATTR ("senile ATTR"), a genetic subtype caused by variants of the transthyretin protein and apparently age-related. [3] Like DCM, most cases of idiopathic MCR are caused by genetic defects, although current knowledge of MCR genetics is still very poor. [4,5] In genetically based RCM, inheritance is usually autosomal dominant. Genes with (non-invasive) RCM mutations include TNNI3, TNNT2, TNNC1, TPM1, TTN, MYH7, MYL2, MYBPC3, MPN, DES, FLNC, LMNA, BAG3 and are associated with DCM, HCM and LVNC. [4,6,7] Most mutations were identified in genes encoding sarcomere proteins, some mutations in sarcomere-associated proteins such as small heat shock proteins such as αB crystallin or binding partners such as BAG3. Several mutations in genes in which proteins are not directly involved in contractile function have been described in RCM patients and include desmin, filamin C and crystallin αB. [8,9] The desmin mutation is usually associated with DCM, but the p.E413K mutation was found in a Polish family with lethal heart disease and adults aged 30–60 years were affected by RCM. [8] Other relatives died suddenly of heart disease at a young age, but the diagnostic confirmation of RCM was not clear. The p.E413K desmin mutation is in a conserved region involved in filament assembly, which is distinct from other mutations found in DCM patients. Aggregates of desmin and disrupted Z-discs were observed in both muscle biopsies and cell culture samples from patients. In addition, another desmin mutation associated with RCM affects the splice region in the DES gene and disrupts the cardiomyocyte filament network. In this case, cardiac symptoms were found in a 46-year-old Polish patient. A homozygous p.Y122H desmin mutation was recently identified in a 19-year-old RCM patient. [9] This mutation is in a region involved in coiled-coil formation of desmin dimers and results in abnormal cytoplasmic aggregation of desmin, suggesting that this region may be a hotspot for cardiomyopathy-associated mutations.

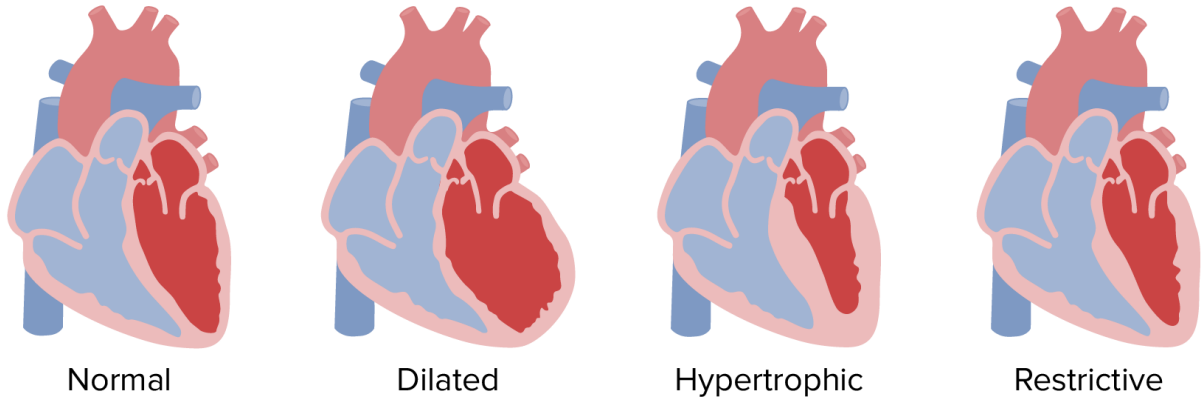

Fig 1. Types of Heart Condition

Restricted cardiometries (RCM) connects to variants in different genes (DCM) when extended cardiosa (DCM) is associated with a large number of generals. [10-14] Family and sporadic conditions of PCM Lamin A (LMNA). [14,15] associated with most of those provided by instructions. Spierystofies. [16,17] Changes to the LMNA gene are not connected to RCM. This report describes an individual with RCM, instruction and skeletal muscle depending on the genetic version of the LMNA

TYPES OF RESTRICTIVE CARDIOMYOPATHY

1. Cardiac Amyloidosis: This is the most common cause of RCM. It can be systemic or localized to the heart muscle. It is characterized by the deposition of amyloid fibrils in the extracellular space. These fibrils are antiparallel, resist proteolysis, and are the main culprit proteins that misfold into β folded sheets that cause oxidative stress, myocardial damage, and myocardial injury [18,19] There are many proteins that can form amyloid, but not all of them affect the heart. The main difference between them is the shape of the protein, the proportions related to the heart and the progression. Amyloid stains pink with hematoxylin and eosin and shows apple green birefringence when viewed in polarized light. The deposition begins under the endocardium and spreads between the muscle fibers in the myocardium. Rarely, the endocardium is not involved, and the pericardium may be a major site of amyloid deposition. [20] Thus, the increased wall thickness is the result of interstitial deposits rather than hypertrophic cardiomyocytes, in contrast to hypertensive heart disease or hypertrophic cardiomyopathy (HCM). Small intramyocardial vessels may infiltrate and cause symptoms of angina, whereas epicardial arteries are angiographically normal. [21-52]

2. Sarcoidosis: Sarcoidosis is a non-systemic granulomatous disease affecting multiple tissues. The respiratory system is most affected, and patients usually have enlarged lymph nodes on a chest X-ray. Damage to the skin, gastrointestinal tract, eyes, and nervous system are common. Cardiac sarcoidosis (CS) is clinically present in approximately 5% of patients, but an autopsy study showed a cardiac prevalence in 25% of cases, [53] with a poor prognosis. [54] Sarcoid granulomas are composed of macrophages and epithelioid histiocytes and lymphocytes. [55] There are three histological stages: edema, granulomatous infiltrate, and fibrosis, but the latter is the most severe and its presence is an independent predictor of death. [56] Cardiac granulomas are frequently found in the basolateral septum, atrioventricular node, bundle of His, ventricular free wall, and papillary muscles. [57] Blood test abnormalities are nonspecific but may indicate elevated ACE levels because they are produced by no squamous granulomas. ECG findings include conduction abnormalities, ventricular arrhythmias (including ventricular tachycardia), and atypical infarct patterns. There is a wide range of echocardiographic abnormalities ranging from wall thickening due to edema and infiltration to wall thinning due to fibrosis. The ventricles may be normal or dilated, with focal abnormalities in wall motion or reduced global systolic function. Regression of scars can lead to aneurysm formation, especially after treatment with corticosteroids. Compared with idiopathic dilated and ischemic cardiomyopathy, the normal motor segment of the SC can alternate with the affected segment [55] and usually does not show coronary spread. [58] CMR can show all three stages of edema, inflammation, and scarring. [59] LGE is stained and occurs mostly in the myocardium and epicardium of the basolateral and lateral left ventricular walls. [60] However, endocardial, or transmural hypertension like the ischemic model has also been observed. [32] The presence, extent, and location of LGE predict the development or death of ventricular arrhythmias and the patient's response to corticosteroid therapy. [56,61,62] 18 Fluorodeoxyglucose (FDG) PET has also been used for diagnostic testing. [63] Perfusion visualization is provided with a rubidium tracer, and metabolic activity is assessed by the degree of 18FDG uptake. Decreased myocardial perfusion due to increased 18FDG uptake is consistent with inflammation, whereas decreased perfusion due to reduced 18FDG uptake is consistent with scar formation. Since PET detects active inflammation before CMR, [64] a hybrid method combining PET and CMR scans allows simultaneous acquisition of structural and functional data, which increases diagnostic accuracy. [65] The first international guideline for the diagnosis of CS [66] included two methods in the diagnostic algorithm: PET and CMR. If clinical symptoms and imaging findings are suspicious, a biopsy of extracardiac tissue is required to clarify the diagnosis. The exception is Lofgren's syndrome (bilateral lymphadenopathy without biopsy, arthritis, and erythema nodosum). Necessary. [57] Although the diagnosis can be made only by EMB, the distribution of granulomas is uneven and the sensitivity is low (20-30%), so it is not preferred because of the risk. [17] PET or CMR-guided cardiac biopsy have increased sensitivity, but negative EMB cannot rule out CS. Treatment of SC includes guidelines for medically directed therapy (GDMT) for heart failure with the addition of corticosteroids to reduce the

inflammatory process (except for asymptomatic hilar adenomatosis that does not require treatment). FDG-PET is recommended in the following treatment algorithm [66] to determine if a satisfactory response to steroids is a problem.

3. Hemochromatosis: Hemochromatosis is a disease in which iron accumulates excessively in the cells of the liver, pancreas, heart, and various endocrine glands, causing liver cirrhosis, diabetes, heart failure, and skin pigmentation. It can be genetic or secondary. In hemochromatosis, [67] if the first name is correctly named, the transferrin iron-binding capacity (TIBC) is lower than the plasma iron level, and erythropoiesis is normal. A secondary disorder, appropriately called hemosiderosis, is due to increased catabolism of red blood cells and often occurs in transfused patients (e.g., thalassemia major). Affecting the heart appears later than other organs and determines the prognosis. In the early stages, the ECG is normal, in advanced disease it is a low-voltage QRS complex with nonspecific deviations of the ST-T segment and supraventricular arrhythmias. Echocardiographic findings may be extensive or rare in RCM and are nonspecific. [68] A liver biopsy is the gold standard for diagnosing hemochromatosis. Serum ferritin concentrations, traditionally used for diagnosis, are a rough estimate of total body iron load. Recently, CMR using the T2 star (T2*) technique has been used to quantify myocardial iron overload. [69] A T2* value of less than 20 msec predicts adverse cardiac events. [70] In addition, it can accurately predict the occurrence of heart failure and cardiac arrhythmia in patients with recurrent transfusions. [64] Some authors advocate its use to assess cardiac iron overload from 5 years of age in patients with thalassemia major receiving suboptimal chelation therapy. [71] Therefore, it is considered the gold standard for iron chelation therapy monitoring and treatment counseling. [72, 73] Treatment with restriction of transfusion, bleeding, and chelation can reverse cardiomyopathy in hemosiderosis, but liver and/or heart transplantation may be required in patients with advanced disease and hemochromatosis. [74]

4. Eosinophilic endomyocardial disease: Eosinophilic infiltration of the heart can occur in a heterogeneous group of conditions called hyper eosinophilic syndrome (HES) and is a rare cause of restrictive cardiomyopathy. SES is either primary or secondary, first described by Loeffler. [75] Eosinophilia is defined as an eosinophil count greater than 500 eos/mm3, with >5000 eos/mm3 affecting the heart more, [76] Eosinophilic degranulation, independent of the main causative factor, affects the endocardium (Loffler endocarditis). [77] Primary HES is defined as an eosinophil count ≥1500 eos/mm3 for 6 months without involvement of other organs and without a secondary cause. [78,79]

Cardiac infiltration consists of three stages:

(a) acute necrotic stage

(b) thrombotic stage and

(c) fibrotic stage.

The first phase is characterized by inflammation in which eosinophilic degranulation releases toxic proteins that cause endocardial necrosis and apoptosis. Rarely, acute necrotizing myocarditis can lead to high early mortality without adequate treatment. If left untreated, the first stage progresses to the thrombotic stage due to continued eosinophil activation. It consists in the formation of a blood clot in the damaged endocardium. There is usually thrombotic destruction of the left ventricular and/or right ventricular apex, which may extend into the ventricular outflow tract, the basal ventricular segment, or even the atria. During this period, the clinical picture is dominated by thromboembolic complications. The final stage results from scarring and irreversible fibrosis of the endocardium (endocardial fibrosis, EMF [1]), which can affect the sub valvular mechanism of both atrioventricular valves. Patients with advanced heart failure and poor prognosis are at this stage. [80,81]

5. Aura Anderson-Fabry: Anderson-Fabry disease is a rare X-linked recessive lysosomal storage disorder caused by mutations in the GLA gene, which encodes α-galactosidase A, which degrades neutral glycosphingolipids. [82] This leads to the intracellular accumulation of glycosphingolipids that cause heart, kidney, and cerebrovascular diseases. Males are more commonly affected and diagnosed earlier (boys on average 5–6 years, girls about 3–4 years) [83-85] and cardiac involvement occurs in adulthood with a life expectancy of 50 years. Chronic neuropathic pain, usually in the hands and feet, may be the first symptom. Children may be stunted and have difficulty doing schoolwork. The main symptoms are gastrointestinal symptoms such as diarrhea and abdominal pain after meals, Angio keratosis, lymphedema, and hyperhidrosis. Microalbuminuria, proteinuria, and renal failure occur late in the disease process and are major causes of morbidity and mortality. [86] Transient ischemic attacks may also occur. Heart disease is caused by the accumulation of globotriaosylceramides in all cellular components of the heart. The classic phenotype is the HCM phenotype and is less restrictive. An ECG with preexcitation [87] or a prolonged PR interval may reveal left ventricular hypertrophy. Arrhythmias can occur in childhood and include bradycardia, supraventricular tachycardia, atrial fibrillation, or atrial flutter. Echocardiographic concentric left ventricular hypertrophy is the most common sign of the development of asymmetric interstitial hypertrophy in approximately 5% of patients. [88,89] Mitral valve anterior systolic motion (AMI) and left ventricular outflow tract obstruction may also occur. Systolic function is preserved and diastolic function is impaired, but restrictive physiology is rare.[90] CMR shows the LGE pattern of the major left ventricular segment and usually spares the sub endocardium. [32] Males can be diagnosed by measuring α-galactosidase A activity or sequencing the GLA gene, while female carriers require gene sequencing because the enzyme activity is normal.[83] Treatment includes GDMT (with careful use of beta-blockers) and enzyme replacement therapy in heart failure, which is effective for myocardial remodeling and improves peak systolic tone and tonicity, [91] but its use is limited in advanced cases.[92] Patients should seek genetic counseling. Descendants of affected families can be tested for α-galactosidase A activity or GLA gene sequencing in males and gene sequencing in females. This may aid in early diagnosis by initiating enzyme replacement therapy before obvious organ damage occurs.

6. Diabetic cardiomyopathy: Diabetic cardiomyopathy (DMCMP) was first described as an enlarged phenotype with reduced ejection fraction (HFrEF). Recent studies [93,94] have also demonstrated a restricted phenotype (HFpEF) with preserved systolic function. These

different models share common pathophysiological mechanisms (autoimmunity, coronary microvascular thinning, hyperglycemia, lipotoxicity, etc.) [95] and appear to have diverse relevance. These differences are important from a therapeutic point of view because the standard treatment of heart failure is of limited value for DMCMP. The diagnosis of DMCMP with a restrictive phenotype (HFpEF) should exclude CAD, valvular, congenital, or hypertensive disease, as well as invasive cardiomyopathy that may require endocardial biopsy.

7. Idiopathic restrictive cardiomyopathy: It is a common primary restrictive cardiomyopathy in women with hemodynamic abnormalities without specific histological changes and without ischemic, valvular, and congenital heart defects or hypertension. Patients usually suffer from heart failure. Echocardiographic findings are also nonspecific and show clear dilation of normal-sized atria and ventricles with preservation of systolic function. Doppler frequency represents an increased LV filling pressure with a limited filling pattern.[96]

8. Progressive systemic sclerosis (scleroderma): Systemic sclerosis is an autoimmune disease that affects almost all organ systems. Myocardial fibrosis causes symptoms of heart failure, and conductive fibrosis can cause ventricular arrhythmias and sudden cardiac death. Physical examination depends on which organ is involved in cardiac symptoms primarily caused by right heart failure (bilateral peripheral edema and increased jugular venous pressure). Echocardiographic findings are consistent with the physiology of restriction.

9. Cardiomyopathy after radiotherapy: Radiation therapy used for thoracic malignancies (Hodgkin's lymphoma, breast cancer, etc.) can cause various cardiovascular diseases, such as coronary heart disease, myocardial fibrosis, valvular heart disease, pericardial disease, and ECG abnormalities. Diffuse interstitial fibrosis [97] eventually reduces tissue elasticity and expansibility [98] after relatively low radiation doses, leading to restrictive cardiomyopathy.

10. Polygonum disease: Danone disease is an X-linked disorder caused by a primary deficiency of lysosome-associated membrane protein 2 (LAMP2). Symptoms appear in adolescence and include heart failure, mental retardation, and skeletal myopathy. Most patients die of heart failure by age 30.[99] Laboratory studies showed that creatine kinase (CK) and liver enzymes (aspartate aminotransferase (AST), alanine aminotransferase (ALT), and lactate dehydrogenase (LDH)) were reduced to 2 to 3 times normal and at least below normal levels. it turns out 1.5 times. Serum aldolase in men. the number of patients. As in Anderson-Fabry disease, the ECG may show normal or elevated QRS voltages, often with extreme hypertrophy (Sokolov score $\geq$ 50) [100] and/or preexcitation. Other ECG abnormalities include nonspecific intraventricular conduction delay, varying degrees of atrioventricular block, sinus bradycardia, and recurrent atrial and ventricular tachycardia. Echocardiography shows severe hypertrophy of both ventricles like HCM, but electrophysiological abnormalities, especially ventricular preexcitation, may provide clues to distinguish the two conditions.[101] In Danon disease, CMR may show subendocardial LGE. [102] A definitive diagnosis is made with a skeletal muscle biopsy. There is no specific treatment.

11.Friedreich Ataxia: It is an autosomal recessive disease caused by repeated guanine-adenine-adenine triplets in the frataxin gene on chromosome 9.[103] Signs include frequent respiratory infections and neuromuscular disorders of the respiratory muscles with heart failure. Echocardiography shows increased ventricular septal or posterior wall thickness with preservation of systolic function.[104]

CAUSES OF RESTRICTIVE CARDIOMYOPATHY [105]

A rare form of heart disease characterized by hardening of the heart muscle, which causes the heart to stretch and reduce its ability to fill with blood. There are many possible causes of RCM, including genetic mutations, systemic diseases, and certain medications. The most common causes of RCM are:

1. Amyloidosis: Amyloidosis is a rare disease in which abnormal proteins accumulate in the tissues and organs of the body, including the heart. This protein can stiffen and thicken your heart muscle, leading to CMR.

2. Sarcoidosis: Sarcoidosis is a systemic disease that affects many organs in the body, including the heart. When sarcoid affect the heart, they can cause inflammation and scarring of the heart muscle, leading to CMR.

3. Hemochromatosis: Hemochromatosis is a genetic condition that causes the body to absorb too much dietary iron. This excess iron can build up in the heart muscle and lead to CMR.

4. Radiation therapy: Radiation therapy for some cancers, such as breast cancer and Hodgkin's lymphoma, can damage the heart muscle and lead to CMR.

5.Idiopathic: Sometimes the cause of idiopathic RCM is unknown, so it is called idiopathic RCM.

DIAGNOSIS OF RESTRICTIVE CARDIOMYOPATHY (RCM)

The clinical manifestations of MCR are very heterogeneous. RCM cannot be questioned based on patient complaints. Patients who are referred to a cardiologist may not be aware of a heart condition until they have a heart evaluation or a physical exam reveals abnormalities, depending on a variety of symptoms or family history. In adolescents and adults, shortness of breath is the most common complaint (71%), followed by edema, palpitations, fatigue, orthostatic breathing, and chest pain. The most common initial presentation in the pediatric population is pulmonary (47%), and these patients were not referred to a cardiologist unless cardiomegaly was detected on chest radiography. Abnormal physical examination (such as cardiac murmur, rhythm, loud P2, edema, ascites, and hepatomegaly) are additional reasons for referring a child to a cardiologist. Syncope, palpitations, fatigue, and chest pain occur in less than 9% of this

population. These findings are based on two studies of a series of patients with idiopathic RCM: Ammash et al. [110] We included the study by Denfeld et al, [123] which evaluated 94 patients (10–90 years) and 79 children and adolescents. In general, despite a variety of reasons for referral, the clinical diagnosis of RCM is based primarily on echocardiography supported by electrocardiography (ECG), cardiac catheterization (hemodynamic assessment), and endocardial biopsy. Coronary angiography is sometimes done to evaluate the structure of the coronary arteries and myocardial perfusion.

Typical Signs of RCM on Echocardiography are

(1) Marked atrial enlargement;

(2) Normal or reduced left ventricular end-diastolic size (LVEDD) and/or volume (LVEDV);

(3) Normal ventricular wall thickness;

(4) Restrictive left ventricular filling pattern evidenced by an increased ratio of early diastolic filling to atrial filling (E/A ratio); and

(5) Normal or near-normal systolic function, expressed as left ventricular partial shortening (LV) or EF.

However, in some cases, a decreased or reversed E/A ratio and/or increased isotopic relaxation time (IVRT) may be observed, indicating decreased relaxation. Among these observations, prolonged IVRT is the earliest sign of compromised relaxation before typical restrictive physiology develops. [124,125] Although systolic function is initially preserved in RCM, this parameter may deteriorate with disease progression. Thus, patients with RCM may present with clinically abnormal systolic function and may not be classified as such due to differences in symptoms and typical manifestations of RCM. Therefore, these patients were largely excluded from retrospective studies of RCM [110,124,126–128] As most available clinical information on RCM is based on retrospective studies, exclusion may adversely affect studies of disease progression. Some RCM hearts may have weak to moderately enlarged ventricles with limited physiologic function. There is uncertainty as to whether it should be classified as RCM or HCM. In a retrospective study of RCM, some groups excluded mildly or moderately enlarged hearts, while others did not. Some future research and events have been diagnosed in the early stages of the disease, other studies can produce hypertrophy, and other studies can be diagnosed with RCM. [129] In addition, all members of the cardiotic family with such pathogenic mutations are in all patients, but some patients and other patients are not increased. [115,127] hypertrophy caused by heart ultrasound. According to a study on one of the largest groups (ENDO -SEx biopsy), patients with epileptic fiber were observed in 81%of idiopathic patients, of whom 86%were increased. [110]

The largest resident of the largest PBF (endomyocardial biopsy obtained from 33 patients) and 81%of patients with interstitial fibers were observed, and 86%were hypertrophy (10) Endocardial biopsy. Coronary angiography is sometimes done to evaluate the structure of the coronary arteries and myocardial perfusion.

In fact, elderly and young patients have different degrees of different degree, with all clinical studies, all clinical studies, diagram, or fibrosis of broken epilepsy. However, questions remain as to whether RCMs are part of the HCM spectrum and whether some HCMs with certain RCM physiology should be considered as a distinct group. ECG recordings are abnormal in 99% of patients with RCM, so they are good for screening. However, the pattern and degree are different. The most reported abnormality is a tall biphasic P wave showing left atrial and/or right atrial enlargement. ST-T wave aberrations are common in RCM, but their specificity is controversial. In a study of 94 patients, 75 reported nonspecific ST-T wave abnormalities.[110] Another study of 12 patients hypothesized that a resting ST segment with delayed T-wave elevation is characteristic of RCM. Ischemia-related ST-segment depression may be induced by exercise in patients with RCM or may occur later in the disease. However, these ECGs were not considered signs of ischemia in this study because they were not supported by myocardial perfusion imaging data.[130] Meanwhile, another study of 18 patients with ischemia linked the same ST-segment changes to ischemia as evidenced by histology.[106] This raises further questions about the role of the dominant ST-T wave shift in RCM.

1.Laboratory test. Restrictive cardiomyopathy must be carefully evaluated because it can be caused by systemic disease or progress to heart failure and affect other organs. Hematocrit (HCT), serum electrolytes, blood urea nitrogen (BUN), creatinine, 24-hour urine total protein, and liver function should be assessed. Arterial blood gases (ABG) should also be measured to monitor for hypoxia. Serum brain natriuretic peptide (BNP) or pro-b N-terminal natriuretic peptide (NT-proBNP) and troponin T are markers of heart failure and predictors of survival in many cases. [106,107] Certain conditions require further investigation (sarcoid angiotensin-converting enzyme,[108] complete blood count (CBC), serum iron concentration, total iron binding by peripheral smear to help diagnose eosinophilia in hyper eosinophilia syndrome). dose and ferritin in ferritin) hemochromatosis, mild κ without immunoglobulins, λ chain test and immunofixation of serum and urine in amyloidosis, etc.)

2.Echocardiography: Echocardiography is the first imaging modality to evaluate patients with dyspnea and/or heart failure. Patients with CMR usually present with nonspecific findings, such as normal (nondilated) ventricles with normal or increased wall thickness, but can sometimes provide definitive clues to the diagnosis. Transmission spectral Dopplers often show rapid early diastolic rates with low or no late filling rates, restrictive filling patterns (E/A ratio > 2, E wave latency < 150 ms, and short isostatic relaxation time < 60 THX). However, this is usually a sign of advanced myocardial damage. Left or bilateral enlargement is usually seen due to chronically elevated filling pressure. Classical systolic function, expressed as ejection fraction (EF), is normal or near normal, but newer techniques such as tissue Doppler and point-monitored echocardiography (STE) detect the presence of hidden systolic myocardial abnormalities that may be characteristic of disease states. Tissue Doppler examination of the mitral annulus shows short systolic waves (S waves), slowing of early diastolic waves, and late diastolic waves that are preserved or interrupted depending on the degree of atrial involvement during myopathy [110, 111]. One of the main uses of echocardiography is the differential diagnosis between constrictive pericarditis (PC)

and PCM. Both present as heart failure with normal-sized ventricles and retain Doppler findings of EF, dilated atria, and increased filling pressure (often with a restricted filling pattern). The differential diagnosis is important because CP can be treated with anti-inflammatory drugs or surgery, while treatment options for RCM depend on the underlying condition. For key differences between these disease states. [112, 113]

3.Cardiac magnetic resonance: Echocardiography cannot definitively diagnose specific subtypes of RCM due to poor tissue characteristics and limited evaluation of the ventricular apex and right ventricle. Cardiac magnetic resonance (CMR) with high spatial resolution and late gadolinium enhancement (LGE) capability can provide detailed information on anatomy, perfusion, ventricular function, and tissue properties. [114] Depending on the scarring pattern, late gadolinium enhancement (LGE) can guide the diagnosis of specific subtypes of MCR. Finally, pericardial thickness can be accurately measured [115, 116] and pericardial inflammation can be visualized, [117] which may aid in the diagnosis of PC.

4.Cardiac CT: At the time of writing, cardiac CT does not play a major role in the examination of patients with RCM. It accurately excludes the presence of obstructive ischemic heart disease in patients with angina symptoms. Its main role is in the differential diagnosis between RCM and CP and can provide important information about the thickness and composition of the pericardium. [118]

5.Invasive catheterization: In current practice, invasive catheterization and coronary angiography are rarely necessary for diagnosis. If chest pain is the predominant symptom, it may indicate the presence or absence of obstructive coronary artery disease. Left and right cardiac catheterization can be used if the results of noninvasive studies, including the differential diagnosis of CP and RCM, are inconclusive. [119]

6.Cardiac biopsy: Endomyocardial biopsy (EMB) carries perioperative risks, but the biopsy may be important for a definitive diagnosis if noninvasive studies have failed. [120] Also, for diseases with focal myocardial involvement (e.g., sarcoid), the biopsy may miss the site of the lesion and give false negative results.

TREATMENT OF RESTRICTIVE CARDIOMYOPATHY (RCM)

Three features of MCR pathophysiology are particularly relevant and influence treatment strategies.

1. The duration of diastole and the increase in filling pressure have a relatively limited effect on the degree of filling of the ventricle, so that stroke volume is almost fixed, and myocardial infarction is mainly caused by changes in heart rhythm.

2. Reverse remodeling (i.e., LV volume reduction and LVEF restoration) is not a therapeutic goal. Conversely, clinical improvement may be associated with modest increases in left ventricular end-diastolic volume and systolic volume. [131]

3. Beta-blockers are intolerable due to their negative chronotropic and, to a lesser extent, nootropic effect. Reducing congestion is the first objective. Loop diuretics reduce pulmonary and peripheral edema and ascites. Forced diuresis should be avoided because even mild hypovolemia can lead to a decrease in volume and heart rate. Obviously, for limited physiology, the strict dependence of heart rate on heart rate means that beta-blockers can impair hemodynamic function and induce hypotension. Patients generally do not tolerate bradycardia well, and bradycardic arrhythmias may require implantation of an atrioventricular sequence pacemaker. Drugs that affect the renin-angiotensin-aldosterone system are not prognostic and may be poorly tolerated because of hypotension.[132]

Atrial fibrillation is common and often poorly tolerated because of the loss of atrial contribution to ventricular filling. Rhythm control is better than speed control, but synchronous rhythm can be difficult to achieve and maintain. CA and AF patients are at very high risk of thromboembolism and should receive anticoagulant therapy regardless of CHA2DS2-VASc score. The same approach should be evaluated for other types of MCRs. The LV cavity can be very low, because the LV support can be very small, because LV is very small, because LV is very small. [133] A heart transplant can be considered in patients selected with other HF etiologists, as well as other HF etiologists, except industrial radiation cardiomyopathy. [134] In recent years, carefully chosen patients, with heart transplant, card transplant, as, carefully chosen patients with CA, and the results were successfully treated with the results compared to other HF reasons. [135] Management of anesthesia can be a problem before transplant. The general principles of postoperative care are to maintain adequate filling pressures, maintain sinus rhythm whenever possible, manage electrolyte imbalance, and monitor systemic vascular resistance at relatively stable cardiac output. Finally, disease-modifying therapies targeting specific proteins or nucleic acids have recently become available for some forms of RCM.

CAUSES OF DEATH

RCM is associated with a high mortality rate, especially in the younger population. Deaths in patients with CMR are either spontaneous (sudden death) or due to chronic heart disease and its complications. In the latter case, heart failure often occurs. However, the underlying causes of sudden death or progressive heart failure in patients with RCM are very unclear and require further investigation. Ischemia is suspected to be the cause of sudden death in patients with RCM. Rivenese et al. [136] proposed a correlation between ischemia and sudden cardiac death (SCD) in RCM based on the clinical profiles of 5 SCD patients. [137-139] All five patients had syncope or chest pain and ST-segment depression or T-wave inversion on an ischemic ECG, but no signs or symptoms of heart failure during cardiac arrest. Four hearts available for necropsy showed evidence of acute and/or chronic ischemia in the subendocardial and papillary muscles. [141-144] Palka et al. Another clinical study conducted by [160] reported the presence of ischemic symptoms and the absence of chronic heart failure (CHF) in a patient with RCM who died suddenly. Several other studies of CMR patients with sudden cardiac death have reported syncope, chest pain, and/or ST-segment depression, but no histologic evidence of ischemia. [159] Therefore, the question of whether ischemia in RCM is the cause of MSC remains open due to lack of histological evidence or wide variation in histological findings. In addition, there are few reports on the direct assessment of coronary microcirculatory function in RCM. However, waiting

for ischemia in congested hearts is not futile because the increased left ventricular pressure and wall stress that occur in congested hearts can lead to increased extravascular pressure and thus reduced subendocardial myocardial perfusion. In addition, reduced capillary density due to interstitial fibrosis and/or muscle fiber disorders common in patients with RCM may also increase coronary microvascular resistance, leading to ischemia. [161-164] Therefore, the presence of ischemia in RCM and its role in disease progression should be further investigated. Arrhythmia is one of the most intensively studied mechanisms in heart disease associated with sudden cardiac death.[165] It is known to cause many deaths in HCM. Baudenbacher et al. recent study. [166] advances the concept that increased myofilament Ca2+ sensitivity may be an independent risk factor for fatal ventricular arrhythmias (see also review by Huke and Knollmann.[167] Since most RCM mutations are associated with increased Ca2+ sensitivity of muscle fibers, affected patients may be expected to be prone to arrhythmias.[168] Abnormal ECG patterns are seen in 99% of patients with RCM, but arrhythmias are present in approximately 15-30%. Atrial fibrillation and atrial flutter are the most common electrocardiographic abnormalities, whereas heart block, bradycardia, and ventricular arrhythmias associated with classical SCD are rare. review. One had torsade de pointes, the other had bradycardia. These two cases, along with four non-SCD cases from the same study, reported ventricular arrhythmias and demonstrated acute/chronic ischemia. It is unclear whether arrhythmias play a major role in sudden death in patients with RCM, as ischemic myocardium has been shown to be fatal ventricular arrhythmias.[165]

Heart failure-related death is the most common outcome of CMR. RCM associated with sarcomere protein mutations causes much more severe heart failure than RCM due to other factors. [169-173] However, it has not been fully implemented due to the rarity of RCM and the lack of early screening indicators for the disease.

A variety of clinical conditions are provided for intensive study of the RCM clinical course. A few cases of MCR in children and adult patients diagnosed early provide valuable information to observe the full development of the disease. Based on these case studies, the typical clinical course of RCM can be described as an initially asymptomatic pattern of RCM reperfusion followed by mild atrial enlargement followed by dyspnea, exercise intolerance, syncope, or other associated symptoms. [145-153,154–157] Over time (months, years, or decades), these symptoms worsen, and diastolic dysfunction and atrial dilatation worsen, eventually leading to heart failure that is fatal unless SCD develops. However, some questions remain. Is systolic function preserved during disease progression? So how can diastolic dysfunction cause heart failure? If not, what affects the systolic function of the RCM heart?

It is interesting to note that preserved systolic function is sometimes impaired in late RCM. [140,154,156-158] However, few published reports provide sufficient information on the prevalence of end-systolic dysfunction in patients with RCM or the role of systolic dysfunction in the development of acute/chronic heart failure in patients with RCM. Ammash et al [140] found systolic dysfunction in 16% of 94 patients with RCM. The percentages may be higher because these analyzes were not limited to late RCM. Weller et al. [156] observed low cardiac output syndrome (low CO) in 18 children with RCM. The remaining 14 initially had mild signs or symptoms, but the latter developed low CO2 over a period of 2.8 ± 2.3 years. Although all 18 patients had preserved ventricular systolic function at diagnosis, 6 subsequently developed ventricular systolic dysfunction, and the remaining 8 patients required contractile support. This suggests that systolic dysfunction may partially contribute to low CO levels in advanced RCM or that low CO may contribute to the development of systolic dysfunction later in the disease. To date, clinical trials have been limited by small numbers of patients, controversial diagnostic criteria, heterogeneous disease manifestations, and lack of screening and/or early diagnostic indicators. Genetic studies of vigorous RCM shed light on pathogenesis and provide a basis for the development of animal models to better understand the mechanisms underlying disease initiation and progression.[174]

PREVENTION OF RESTRICTIVE CARDIOMYOPATHY (RCM)

Restrictive cardiomyopathy is a rare form of heart disease characterized by hardening of the heart muscle, making it difficult for the heart to fill with blood. There is no known cure for this condition, but there are steps you can take to prevent or slow its progression. One of the most important ways to prevent restrictive cardiomyopathy is to manage the underlying conditions that contribute to its development. For example, some of the conditions that can lead to restrictive cardiomyopathy include amyloidosis, sarcoidosis, and hemochromatosis, so it is important to monitor and treat if you have these conditions. Another important aspect of prevention is a healthy lifestyle, including regular exercise, a balanced diet, and avoiding smoking and excessive alcohol consumption. Exercise helps keep your heart strong and healthy, and a healthy diet helps control blood pressure and cholesterol levels, which are also risk factors for restrictive cardiomyopathy. In addition, it is important to regularly monitor your heart health through a medical exam, especially if you have a family history of heart disease or if you have symptoms of heart disease, such as shortness of breath or chest pain.

PROGNOSIS OF RESTRICTIVE CARDIOMYOPATHY (RCM)

Although RCM is specific to the specific type, it usually worsens with progressive deterioration despite optimal treatment, especially in children**.**

CLINICAL PRESENTATION AND PHYSICAL EXAMINATION

Patients often present with shortness of breath, fatigue and limitation of physical activity, palpitations and fainting, angina pectoris. Others may experience thromboembolic complications. Physical examination may reveal signs of congestive heart failure (distension of the jugular vein, sometimes with Kussmaul's sign, bilateral peripheral edema, respiratory fat, hepatomegaly, ascites, S3 and S4 gallop). The ECG may show left or bilateral widening or a sinus rhythm with signs of atrial fibrillation. Nonspecific ST and T wave abnormalities may be present. In prethoracic leads, the QRS voltage may be low and conduction disturbances may be present, especially in invasive disease. Depending on the underlying cause and helpful diagnostic tests, certain ECG findings may be present.

CONCLUSION

Restrictive cardiomyopathy (RCM) is a rare but serious heart disease in which the heart becomes stiff and has difficulty filling with blood. It is characterized by diastolic dysfunction, which means that the heart does not relax and fill adequately with blood during the resting periods of the cardiac cycle. RCM is caused by several underlying conditions, including genetic mutations, invasive disorders (such as amyloidosis), and idiopathic (unknown) causes. The most common symptoms of RCM are shortness of breath, fatigue, and swelling of the legs and feet. The diagnosis of RCM usually involves a thorough history and physical examination, as well as a variety of imaging tests, such as echocardiography, MRI, and cardiac catheterization. Treatment options for RCM are limited and often focus on symptom management and treatment of the underlying condition. In conclusion, RCM is a rare but serious cardiac disease that can significantly affect patients' quality of life. Early diagnosis and appropriate treatment are important to improve outcomes and prevent complications.

RESULT

Restrictive cardiomyopathy (RCM) is a rare form of cardiomyopathy, a disease of the heart muscle. During CMR, the heart muscle hardens and stiffens, limiting the heart's ability to fill with blood during the relaxation period between heartbeats. This can cause a variety of symptoms, including shortness of breath, fatigue, swelling of the legs and feet, and an increased risk of heart failure. CMR has several causes: Infiltrative disease: CMR can be caused by the accumulation of abnormal substances in the heart muscle, such as amyloid protein or sarcoid granulomas. Storage disorders: Some genetic disorders, such as Fabry disease and Gaucher disease, can cause abnormal substances to build up in the heart muscle. Radiation therapy: RCM can sometimes be a complication of radiation therapy, especially if the radiation is focused on the chest. Idiopathic: In some cases, the cause of RCM is unknown. The diagnosis of RCM is usually made using history, physical examination, imaging studies, and laboratory tests. Treatment options depend on the underlying cause of the condition and may include medications, surgery, or other interventions to manage symptoms and improve heart function. Overall, RCM is a rare and potentially serious condition that requires careful diagnosis and treatment by a team of medical professionals, including cardiologists, radiologists, and other specialists as needed.

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