Myocarditis — Symptoms and Treatment

Myocarditis is an inflammatory disease of the heart muscle, which mostly arises due to infections with cardiotropic viruses, especially infections with the coxsackie virus. The course of myocarditis, in contrast to endocarditis, is usually slower and less distinct.

Definition of Myocarditis

Myocarditis is a term used to describe the process of the inflammation if myocardium, which is considered the contractile layer of the heart. Therefore, specific consequences may occur later on, such as heart failure.
Epidemiology of Myocarditis

The annual incidence of Myocarditis is estimated to be around 17 per 100,000 population. Fatality is less than 2% of all the cases.

In cases of infections with the **coxsackie B virus**, it can be assumed that in about 4% of all cases, the heart will be affected as well. For other **cardiotropic viruses**, this number goes down by about 1% of all cases. When young adults die from a sudden cardiac arrest, in about 10% of the cases, the autopsy will reveal myocarditis.

Etiology of Myocarditis

Myocarditis may be caused by one or more of the following:
1. Infectious organisms.
2. Autoimmune disorders.
3. Exogenous agents.
5. Environmental causes.

A distinction is made between infectious and non-infectious forms. The coxsackie B virus is often the trigger of the infectious form. Other entero-, adeno-, and influenza viruses, or for example EBV, CMV, HCV, or HIV can also lead to myocarditis. Bacteria are able to induce myocarditis as well. This includes primarily staphylococci and streptococci, and also enterococci and Borrelia burgdorferi. Fungi, protozoa, and parasites may also be the cause.

In rare cases, chronic systemic diseases, such as rheumatoid arthritis, vasculitis and collagenoses can be triggers of non-infectious myocarditis. Medications may cause the so-called hypersensitivity myocarditis. An idiopathic Fiedler’s myocarditis or myocarditis following radiation therapy to the mediastinum are also possible.

<table>
<thead>
<tr>
<th>Viral infections (most common)</th>
<th>Bacterial infections (occasional)</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Enteroviruses</td>
<td>• Bacteremia</td>
</tr>
<tr>
<td>• Adenoviruses</td>
<td>• Direct extension from contiguous focus</td>
</tr>
<tr>
<td>• Parvovirus B 19</td>
<td>• Bacterial toxin</td>
</tr>
<tr>
<td>• Human herpesvirus 6</td>
<td></td>
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<tr>
<td>• Dengue viruses</td>
<td>Parasites</td>
</tr>
<tr>
<td>• Cytomegalovirus</td>
<td>Trypanosoma cruzi</td>
</tr>
<tr>
<td>• Coxsackie virus</td>
<td></td>
</tr>
<tr>
<td>• Poliovirus</td>
<td>Miscellaneous causes</td>
</tr>
<tr>
<td>• HIV</td>
<td>• Toxins: chemotherapy (Doxorubicin), drugs, ethanol</td>
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<tr>
<td></td>
<td>• Immunological causes: allergic reactions, post-transplant rejection, autoimmune</td>
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**Classification of Myocarditis**

Myocarditis can be classified according to its course or its pathogenesis. Regarding its course, an **acute** and **chronic myocarditis** are to be distinguished. According to its pathogenesis, **infectious myocarditis**, **toxic myocarditis**, **idiopathic myocarditis** and **autoimmune myocarditis** must be distinguished from each other.

**Pathophysiology of Myocarditis**
First, the virus damages myocardial cells, which triggers an immune reaction. This can cause the destruction of other myocardial cells or cause cross-reactions between viral and myocardial structures, which produces antibodies. This eventually lead to inability of the heart to pump properly, resulting in picture of heart failure (Viral myocarditis).

Pathology of Myocarditis

Histologically, Myocarditis can be divided into the following categories:

- Eosinophilic
- Granulomatous
- Lymphocytic
- Contraction band necrosis, reperfusion

Initially, viral infections typically present with a **serous exudate** and **hypereosinophilia**. Later, the fibrotic replacement of cardiac muscle cells can be found. In infections caused by bacteria, **microabscesses** that are **rich in granulocytes and bacteria** are present.

Symptoms and Clinical Presentation of Myocarditis

Typically, the onset and progress are **slow** and **non-specific**, involving symptoms such as **fever**, **fatigue**, or **chest pain**. During the course of the disease (days to weeks), **signs of heart failure** and **arrhythmia**, as well as tachycardia, develop. Rarely, the course may be fulminant and similar to an infarction.

<table>
<thead>
<tr>
<th>Unexplained heart failure</th>
<th>Arrhythmia</th>
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<tbody>
<tr>
<td>Chest pain</td>
<td>• Supraventricular tachycardia</td>
</tr>
<tr>
<td></td>
<td>• Ventricular extrasystoles</td>
</tr>
<tr>
<td>May mimic acute MI</td>
<td><strong>Cardiac abnormalities developing during</strong></td>
</tr>
<tr>
<td></td>
<td><strong>recognized systemic infection</strong></td>
</tr>
<tr>
<td></td>
<td>E.g. fever, malaise, arthralgias, respiratory symptoms</td>
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</tbody>
</table>

Diagnostics of Myocarditis
Laboratory diagnostics of myocarditis

The patient’s medical history often reveals evidence of a previous infection. Clinical signs can be combined with laboratory values, such as a possibly elevated ESR, raised CRP, troponin, and CK-MB, as well as with bacteriological and viral diagnostics. ECG may show non-specific changes. A diagnosis is confirmed after detection of the pathogen in a myocardial biopsy.

Differential Diagnosis of Myocarditis

Similar diseases to myocarditis

A distinction must be made between post-myocardial cardiomyopathy, viral myocarditis as well as virus-positive myocarditis and inflammatory dilated cardiomyopathy (DCM).

Treatment of Myocarditis

Therapeutic approaches for myocarditis

Initially, the treatment of myocarditis is symptomatic. Physical rest, abstinence from alcohol, thromboembolism prophylaxis and the treatment of complications such as heart failure are indicated. Moreover, the therapeutic approach may be causal, being directed at the causative disease, for example diphtheria or Chagas disease. As part of research studies, anti-viral and immunosuppressive treatments are also performed.

<table>
<thead>
<tr>
<th>Supportive therapy - hemodynamically stable patients</th>
<th>Chagas disease</th>
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<tbody>
<tr>
<td>Heart failure:</td>
<td>Anti-trypanosomal therapy:</td>
</tr>
<tr>
<td>• Angiotensin-converting enzyme inhibitors</td>
<td>• Benznidazole</td>
</tr>
<tr>
<td>• β-adrenergic blockers</td>
<td>• Nifurtimox</td>
</tr>
<tr>
<td>Anti-viral therapy: limited applications</td>
<td>Immunosuppression</td>
</tr>
<tr>
<td></td>
<td>Not for routine use</td>
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Complications of Myocarditis

Complications of myocarditis include:

- Idiopathic dilated cardiomyopathy
- Cardiac Insufficiency
- Cardiac arrhythmias

Prognosis of Myocarditis

Partial or full clinical recovery can be expected. Relapse is also a possibility. Unresolved cases may lead to dilated cardiomyopathy. Indicators of advanced cardiomyopathy may warrant heart transplantation.
Review Questions

The answers can be found below the references.

1. Which is the most common trigger of infectious myocarditis?
   A. Staphylococci
   B. Streptococci
   C. Cardiotropic viruses
   D. Fungi
   E. Parasites

2. How can the diagnosis of myocarditis be confirmed?
   A. Measurement of troponin
   B. Increased ESR
   C. Myocardial biopsy
   D. Determining the CK-MB level
   E. Changes in the EKG

3. Which of the following is least likely to be part of the clinical manifestation of myocarditis?
   A. Serous exudate
   B. Hypereosinophilia
   C. Fibrotic replacements
   D. Hypertrophic myocytes
   E. Microabscesses rich in bacteria

References


Moon, R. O. (1912). The prognosis and treatment of diseases of the heart.


Correct answers: 1C, 2C, 3D

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