Clinical parameters have to be met in order to make the diagnosis of shock. However, differential diagnosis is also of great importance since without knowing the cause, this life-threatening condition can recur at any time.

Definition of Shock

The life-threatening state of shock

The relevant parameters that characterize the clinical picture of shock are an arterial blood pressure, with a systolic pressure below 90 mmHG or significantly lower than the baseline value. Moreover, an increased heart rate can be observed in most cases, the pulse is fast and thread-like. Thread-like describes a pulse that is weak, filled, quickened, difficult to palpate and easy to suppress. The cardiac output can be decreased significantly. Furthermore, changes in the state of consciousness can be observed. Further symptoms are:

- Decreased urinary excretion
- Pale, cold, marbled and cyanotic skin

**Note:** The cardinal symptoms of shock are: hypotension, disturbed consciousness, oliguria and metabolic acidosis.

### Definition of Hypotension
- Less than 100 mm Hg systolic blood pressure (normal = 120/80 mm Hg)
- Common symptoms: fatigue, dizziness, occasionally fainting
- Patients may have a fast or slow heart rate
- The skin is warm and not sweaty although some patients may have cool, sweaty skin
- Often related to dehydration or blood loss

<table>
<thead>
<tr>
<th></th>
<th>Normal</th>
<th>Shock</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Defense mechanisms</strong></td>
<td>Maintain a normal blood pressure</td>
<td>Are overwhelmed; blood pressure decreases</td>
</tr>
<tr>
<td><strong>Circulating components of the immune system</strong></td>
<td>Fight invading bacteria</td>
<td>Are released in high concentrations and cause organs to malfunction; blood pressure drops</td>
</tr>
<tr>
<td><strong>Blood vessels</strong></td>
<td>Constrict and raise blood pressure</td>
<td>Dilate, which decreases peripheral vascular resistance and blood pressure</td>
</tr>
</tbody>
</table>

### Types of Shocks and their Development

Shock is a condition with **inadequate perfusion of tissue**. This means that there is insufficient oxygen transport and a disturbed removal of metabolic degradation products.

There are different types of shock. However, treatment always starts with a diagnosis, which has to be made fast and is, therefore, a major challenge for preclinical and medical care. There is a **risk of multiple organ failure**, yet other causes for signs of shock have to be considered within the scope of differential diagnoses.

**Note:** The phases of shock can be differentiated into three stages. The first one is also referred to as the compensated stage, the second one is the decompensated stage and the third one the irreversible stage.
### Anaphylactic Shock

#### Definition and etiology of anaphylactic shock

Anaphylaxis is an **acute and systemic reaction** that is characterized by symptoms of an allergic shock. Its course can be life-threatening. Anaphylactic shocks are amongst the **most severe** allergic reactions of the body.

There is no standardized definition that is used globally. In Germany, anaphylactic shocks refer to an **acute, pathologic reaction of the immune system in response to a chemical stimulus**, which affects the whole organism. Shocks like this can occur in humans and animals.

#### Epidemiology and cardinal symptoms of anaphylactic shock

![Signs and symptoms of Anaphylaxis](image)  
*Image: “Signs and symptoms of anaphylaxis.” by Mikael Häggström. License: [CC0 1.0]*

There are different triggers for an anaphylactic shock that can hardly be determined at first glance. Additionally, triggers can also be **hidden in foodstuff**, which can lead to a dangerous delay of their identification, especially if rare triggers are involved.
Medicaments and foodstuff are identified particularly frequently as triggers. Nuts, seafood and celery being the most common among foodstuff. Further possible triggers are chicken eggs and insect poisons.

Anaphylactic shock may also be caused by a combination of different factors. In this case, we speak of allergen exposure. This is possible e.g. at concurrent stress after the consumption of alcohol or acute infections. 58 % of the factors causing anaphylactic shock in children are foodstuff, approximately. 24 % insect poisons and 8 % medications. For adults, anaphylactic shock is triggered to 16 % by foodstuff, to 55 % by insect poisons and to 21 % by medication.

Severity levels of anaphylactic shock

Anaphylactic shock can occur in four degrees of severity.

1. Degree - lightest form

The patient feels light reactions that can be accompanied by dizziness and headache. Skin reactions are possible as well. This includes: itching, skin redness with sensible heating of the skin and nettle rash (generalized urticaria). This condition is not life-threatening. However, it requires clarification. Prominent features are conjunctivitis and rhinitis as well as general restlessness.

2. Degree

Second-degree shock includes symptoms of the first degree. Additionally, further signs like tachycardia and dyspnea can be observed. Vomiting and nausea are also possible. Furthermore, urge to defecate arises. The patient complains about dizziness.

3. Degree

Symptoms of the first and second degree are present. Characteristics of the third degree are bronchospasms with clear dyspnea. Hoarseness, drowsiness, and fear are visible. The Quincke’s edema may occur, which can cause laryngeal swelling (Quincke’s edema see below).

4. Degree

Fourth degree anaphylactic shock causes respiratory failure, heart failure, and circulatory arrest. Uncontrolled stool and urine excretion occur. This condition is life-threatening.

Differential Diagnosis of Anaphylactic Shock:

Formation of Edema

Formation of edema as similar clinical picture

Edemas can occur due to anaphylactic shock. However, they can also have a completely different trigger. Edemas are classified among others according to their localization. They can be generalized (symmetrical), localized (on one - or both sides). They can also be located peripherally.

Peripheral edemas are located e.g. inside the ankles but also in the lower leg. Bedridden patients can also have sacral edemas.
A different classification considers the results of palpation. **Pitting edemas** give way when palpated whereas **non-pitting edemas** do not give way. Consistency, which means whether the edema is soft or hardened, is also of importance.

**Quincke’s edema**

Quincke’s edema, also referred to as **angioedema**, occurs acutely and can last up to three days. It is a swelling found especially in the face (lips and eyelids) but also hands, feet and genital area can swell dramatically. Quincke’s edema becomes life-threatening if the upper airways swell up.

**Differential diagnosis Quincke’s edema**

Quincke’s edema can be **caused genetically** and is triggered by an enzyme deficiency. This is the case in the so-called **hereditary angioedema**, which is, however, very rare. Another trigger can be physical stimulations. Furthermore, Quincke’s edema can be an **accompanying symptom for chronic infections** as well as **autoimmune diseases**. There is also an idiopathic type, which means a form of Quincke’s edema with an uncertain cause.

**Reinke’s edema**

Reinke’s edema is a **disease of the vocal folds** due to the collection of **tissue** fluid. It can occur unilaterally, bilaterally or even affect the entire vocal folds. The patient notices his voice becoming lower or “tilting”. Talking over extended periods becomes difficult. **Hoarseness** can be an accompanying symptom.

**Treatment of Reinke’s edema**

Reinke’s edemas are treated with sprays containing cortisone to reduce the swelling. Chemical fumes and other noxious influences like smoking, which are usually the cause for Reinke’s edemas, should be avoided. In severe cases, surgery may be necessary.

**Perifocal Edema**

Perifocal edema is located in **healthy tissue surrounding the focus of disease**. It occurs in the case of e.g. abscesses but also tumors and bleedings. They are also a possible complication after radiotherapy.

**Pretibial edema**

Pretibial edemas are **collections of fluid in the subcutaneous tissue of the shinbone** (tibia). Occurrences of pretibial edemas are a sign of disturbed lymph circulation. Pretibial edemas are easy to diagnose but they can have many different causes.
Possible causes for pretibial edemas

Especially right heart failure has to be considered as a possible cause (cardiac edema). It may also be chronic venous insufficiency. Furthermore, endocrine diseases can lead to the formation of pretibial edema (myxedema) and it may also be possible to find the reason for said edemas within the lymphatic system. A diagnosis is absolutely necessary since pretibial edemas can be of dangerous but also the harmless origin.

Hemorrhagic Shock

Definition of hemorrhagic shock

The reason for the hemorrhagic shock is blood loss (hypovolemic shock), which is not necessarily visible. Possible are gastrointestinal bleedings, ruptures of vessels also after accidents, gynecologic bleeding sources but also tumors or chronic inflammations. Hemorrhagic shock is graded into four stages depending on the amount of blood loss.

Classes of hemorrhage

- Class I hemorrhage → the patient compensates for blood loss through a sympathetic response that induces:
  - Mild tachycardia
  - Peripheral vascular constriction (capillary refill is maintained (< 2 seconds))
- Class II hemorrhage → all of the manifestations can be attributed to further increases in sympathetic discharge and shunting of blood from less critical vascular beds such as the skin, leading to skin vasoconstriction ⇒ skin is cold & moist
- Class III hemorrhage → Decompensation = Hypotension (can no longer maintain their blood pressure at normal levels) despite further increases in heart rate and peripheral vascular constriction. Leading to:
  - Decreased level of consciousness
  - Further decrease in urine output due to poor cerebral and renal perfusion, respectively
- Class IV hemorrhage → patient appears lethargic, tachypneic and has markedly decreased urine output. Circulatory failure & death are imminent ⇒ without therapeutic intervention

Degrees and etiology of hemorrhagic shock

- 1st Degree ⇒ blood loss up to 750 ml
- 2nd Degree ⇒ blood loss from 750 to 1500 ml
- 3rd Degree ⇒ blood loss of approx. 2000 ml
- 4th Degree ⇒ blood loss over 2000 ml

Hemorrhagic shock of 1st and 2nd degree is also referred to as compensated shock. From 3rd degree upwards, the shock is decompensated. As soon as the blood loss exceeds 50% the condition becomes life-threatening. The patient is usually unconscious and the risk of circulatory collapse is likely.
Further causes of hemorrhagic shock

Hypovolemic shocks can also be a result of loss of electrolytes, which can occur in cases of severe diarrhea. Possible reasons are also severe burns as well as serious hyperthermia and insufficient intake of fluids, which, particularly among elderly people, is not uncommon.

Therapy of hemorrhagic shock

The fluid balance has to be restored as soon as possible, even if the patient is in a 1st or 2nd degree shock condition. Otherwise, severe complications can occur, even if the patient’s life has been saved. The bleeding has to be stopped as soon as possible.

Signs for improvements of the condition

A number of signs indicate an improvement of the shock condition. This includes an improvement of the vital signs as well as an increase in pulse and blood pressure. However, the patient may still not be responsive.

Differential Diagnoses of Hemorrhagic Shock

Possible differential diagnoses are simple drops in blood pressure that can also lead to collapse. In this case, the condition is usually already improved by a low positioning of the head. From a differential diagnosis point of view, the drop in hemoglobin is missing in simple drops of blood pressure. Another possible cause is a vasovagal syncope.

Cardiogenic Shock

Definition and etiology of cardiogenic shock

Cardiogenic shock is caused by primary systolic failure of the heart. The skin turns pale but the cardiac output may be normal. The PCWP (pulmonary capillary wedge pressure) is increased. Arterio-venous $O_2$-difference and TPR (total peripheral resistance) increase as well.

Reasons for cardiogenic shock can be either myocardial or mechanical. Myocardial reasons include myocardial infarction, myocarditis, cardiomyopathies, toxicity of pharmaceutics and myocardial ischemia. Mechanical causes include pulmonary embolisms, artificial valve dysfunctions or diseases of the heart valves but also pericardial tamponades, intracavitary disturbances of fluid movement or pericarditis constructiva.

Symptoms and diagnosis of cardiogenic shock

The patient is confused or suffers from another form of disturbed consciousness. The mortality rate remains high, even if the patient is hospitalized. Blood pressure can be normal. Visible symptoms are moist and cold skin, cyanosis, tachycardia and oliguria. Cardiogenic shock is known as the most frequent cause of death in cases of acute myocardial infarction.

Note: Up to 80 % of all cardiogenic shocks are triggered by acute myocardial ischemia.
Echocardiography and right heart catheters are used to diagnose cardiogenic shock.

Differential Diagnoses of Cardiogenic Shock

Whether the diagnosis of cardiogenic shock is right can be clarified using echocardiography and right heart catheters. In case of a **circulatory-obstructive shock**, which occurs due to pulmonary embolisms, a massive right ventricular load and a simultaneously good left ventricular contractility can be observed.

Review Questions

The correct answers can be found below the references.

1. **Characteristics of shock are for example:**
   - A. Diastolic arterial blood pressure above 90 mmHG
   - B. Venous blood pressure below 90 mmHG
   - C. Systolic arterial blood pressure below 90 mmHG
   - D. Non-palpable pulse
   - E. Not measurable blood pressure

2. **The Quincke’s edema...**
   - A. ...is a harmless accompanying symptom.
   - B. ...is always life-threatening.
   - C. ...is not of genetic origin.
   - D. ...can be of genetic origin.
   - E. ...causes enzyme deficiency.

3. **The edema...**
   - A. ...can be a sign of anaphylactic shock.
   - B. ...is always localized bilaterally.
   - C. ...never occurs sacral.
   - D. ...always gives way when palpated.
   - E. ...is hardened.

References


**Correct answers:** 1C, 2D, 3A

**Legal Note:** Unless otherwise stated, all rights reserved by Lecturio GmbH. For further legal regulations see our [legal information page](#).