

# Cardiac glycosides

**Cardiac glycosides** are a group of **plant-derived** substances that play an essential role in the treatment of heart failure. They are used when there is a need to strengthen the contractility of the failing heart in order to achieve sufficient cardiac output.

The main representative of this group is **digoxin**. Digitoxin, methyl digoxin, and strophanthin (ouabain) were also formerly used.

## Chemical structure

The cardiac glycoside molecule consists of a sterol nucleus, an unsaturated lactone ring and a sugar component .



ampule 0,25mg of digoxin

[https://www.wikiskripta.eu/w/Soubor:Srdecni\\_glykosidy.png#/media/Soubor:Srdecni\\_glykosidy.png](https://www.wikiskripta.eu/w/Soubor:Srdecni_glykosidy.png#/media/Soubor:Srdecni_glykosidy.png)

## Mechanism of action

Cardiac glycosides have positive inotropic effects on cardiac muscle, they can increase myocardial contractility. The action of the drug starts at the cell membrane of the heart cell, where the drug has **inhibitory** effects on the **sodium-potassium pump** ( $\text{Na}^+/\text{K}^+$ -ATPase), which is responsible for the normal distribution of ions between the cell and the extracellular environment. As a result of the decrease in sodium pump activity, sodium cations accumulate inside the cell, causing an unfavourable gradient for  **$\text{Na}^+/\text{Ca}^{2+}$  changing pump**, which normally pumps 3 sodium cations into the cell in exchange for 1 calcium cation. Due to increased intracellular sodium levels, the work of the  **$\text{Na}^+/\text{Ca}^{2+}$  exchange pump** is weakened and thus the intracellular calcium increases. The inotropy is due to the concentration of intracellular calcium and therefore its intracellular rise will result in increased myocardial contractility.

Cardiac glycosides also act **indirectly** to slow the heart rate by **increasing** vagal nerve **activity**.

## Effects

- due to vagal irritation, the heart rate slows down
- **slowing of conduction through the A-V node**
- positive inotropic effects on cardiac muscle, can increase myocardial contractility
- increase baroreceptor sensitivity
- increase left ventricular ejection fraction

Due to vagal irritation, digitalis glycosides have negative dromotropic and chronotropic effects. Traditionally, cardiac glycosides have been used to maintain control of atrial fibrillation.

## Indications

Cardiac glycosides are most commonly given to patients with heart failure accompanied by atrial fibrillation or atrial flutter.

## Contraindication

### Absolute:

- hypertrophic obstructive cardiomyopathy

- A-V block
- hypokalemia
- hypercalcemia
- ventricular tachycardia
- heart failure with slow sinus rhythm
- sick-sinus syndrome
- Wolff-Parkinson-White syndrome
- carotid sinus hypersensitivity

#### Relative:

- cor pulmonale
- pulmonary embolism
- acute myocardial infarction with sin. rhythm
- mitral stenosis
- constrictive pericarditis
- acid-base imbalance
- myocarditis

## Dosage

For digoxin and other substances in this group, there is a very small margin between the therapeutic and toxic dose. Recommendations based on results from observational studies are that plasma concentrations should not exceed **2 ng/ml**. For a patient of normal weight and sinus rhythm, a daily dose of 0.125 mg is appropriate. Digoxin is eliminated from the body by the kidneys and therefore a lower dose should be given in patients with renal insufficiency.

## References

### Related articles

- Cardiotonics
- Atrial Fibrillation
- Atrial Flutter
- Antiarrhythmics
- Heart rhythm disorders

### External links

- Digoxin a EKG (TECHmED) (<https://www.techmed.sk/digoxin/>)
- Intoxikácia digoxínom a EKG (TECHmED) (<https://www.techmed.sk/intoxikacia-digoxinom/>)

### References

1. ↑ WIDIMSKÝ, Jiří. *Heart Failure*. 2nd extension and rework. ed edition. Prague: Triton, 2003. 556 pp. ISBN 8072543857 .
2. ↑ WIDIMSKÝ, Jiří. *Heart Failure*. 2nd extension and rework. ed edition. Prague: Triton, 2003. 556 pp. ISBN 8072543857 .
3. ↑ ASCHERMANN, Michael, et al. *Cardiology*. 1st edition. Galén, 2004. 0 pp. ISBN 80-7262-290-0 .

### References

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- VÍTOVEC, Jiří a Jindřich ŠPINAR. *Farmakoterapie kardiovaskulárních onemocnění*. 1. vydání. Praha : Grada, 2000. ISBN 8071695521.

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