What you need to know about asthma treatment

What is Asthma?

Asthma is one of the most frequent chronic diseases. Hippocrates had already described it in classical antiquity. An inflammation and hyper-responsiveness of the airways leads to a variable and reversible constriction of the airways. There is a genetic predisposition for the different forms of asthma. It is frequently hereditary with typical onset during infancy. However, non-allergic asthma usually arises during adulthood.

The factors inducing an asthma attack are numerous: pollen, dust, contact with animals, workplace chemicals, medicines (e.g. acetylsalicylic acid, non-steroidal anti-inflammatory drugs), viral infections, cold air, psychological and physical strains. Airborne pollutants such as nitrogen oxides, ozone and dust are the main causes of the worldwide increase observed in asthma.

Although the adult population frequency amounts to approximately 5%, a frequency of 10-15% is assumed in athletes. Exercise-induced asthma is the term given to asthma which only occurs during physical strain. The inhalation of large volumes of cold dry air with the subsequent development of an edema within the airways seems to play a substantial role. The symptoms are normally pronounced towards the end of strenuous physical loads, so complaints from games usually arise during the intervals. Breathlessness, rhonchus and coughing are typical. Athletes participating in winter sports are more frequently affected than those in summer sports. Endurance athletes also suffer more frequently from asthmatic complaints than other sportsmen.

Competitive swimmers who train several hours a day inhale substantial quantities of chlorine gas that can cause asthma attacks. Therefore, despite the favorable humid conditions, the frequency of exercise-induced asthma among swimmers is particularly high.

How Asthma is diagnosed

Respiratory symptoms may have many causes. Physiological shortness of breath (e.g. wheezing) is often associated with high-intensity exercise in poorly conditioned individuals that may lead to a misdiagnosis of asthma. For a reliable diagnosis, lung function tests are necessary. In pronounced cases, a simple spirometry test measuring the forced expiratory volume for one second (FEV₁) is sufficient. This is the volume of air that can be exhaled after maximum inhalation within the first second (Figure 1). If the FEV₁ is reduced but rises after inhalation of a beta-2 agonist by at least 12%, asthma can be assumed to be present. In most cases, particularly with exercise-
induced asthma, provocation tests are necessary. These can be accomplished using an exercise test on an ergometer in the laboratory or under sport-specific conditions with field tests. Lung function is determined before and after the effort. The test is considered positive if the FEV₁ drops by more than 10% after exercise. Another lung function test involves the inhalation of test substances such as methacholine, which induces bronchoconstriction. When allergy-induced asthma is suspected, diagnostic allergy tests are necessary.

**How asthma is treated**

For the player, the goal of therapy consists of being symptom-free and being able to maintain a normal lung function during sports activities. When asthma only occurs rarely or intermittently, short-acting inhaled beta-2 agonists (salbutamol or terbutaline) are sufficient. For exercise-induced asthma, a beta-2 agonist should be inhaled shortly before starting the exercise that causes the complaints. When asthma attacks occur once a day, a continuous therapy with an inhaled beta-2 agonist, possibly also with long-acting substances (formoterol or salmeterol) in combination with inhaled glucocorticosteroids, is recommended. Glucocorticosteroids are used to combat the inflammation, but do not give relief in acute attacks. Alternatively, or in supplementation, so called leukotriene antagonists and cromolyn compounds may have a preventive effect. Theophylline derivatives are less suitable for athletes.

**Do Beta-2 agonists enhance performance?**

Of the drugs normally used for asthma treatment, beta-2 agonists and glucocorticosteroids are on the list of prohibited substances. For the prophylactic treatment of asthma and exercise-induced asthma, inhalational application is permitted, but need a Therapeutic Use Exemption (TUE) – in this case an abbreviated TUE. Copies of lung function and/or provocation tests (see above) have to be enclosed with the application for TUE.

In contrast to glucocorticosteroids, inhaled beta-2 agonists, or asthma sprays, are not only banned for competition but also for training. Abbreviated TUEs are acceptable for the beta-2 agonists formoterol, salbutamol, salmeterol and terbutaline. Nevertheless, a salbutamol concentration in the urine of >1000 ng/ml is usually not reached by inhalational application and is therefore considered a positive doping test. Players seeking a competitive advantage, even after allowing for commonly existing medical conditions, frequently abuse inhaled beta-2 agonists. But do asthma sprays actually affect performance? Since 1983, numerous placebo-controlled studies have
been published that have looked at the effect of inhaled beta-2 agonists on the aerobic and anaerobic performance as well as on muscle strength in highly trained athletes. Most studies did not show any improvement in performance.

In contrast to inhaled beta-2-agonists, oral administration of salbutamol and clenbuterol might have ergogenic effects, but most of the relevant findings, however, originate from animal experiments. It is important to be aware that overdoses may cause relevant side-effects such as heart palpitations, very rapid heartbeat and rhythm disturbances or tremor.

Altogether, based on scientific evidence, inhaled beta-2 agonists do not appear to have a performance-enhancing effect in non-asthmatic athletes. Or, to put it differently: one does not have to be asthmatic to succeed. It would be desirable to separate fact from fiction regarding the value of asthma sprays and get this message to the athletes.
Fig. 1: Forced expiratory volume in 1 sec (FEV₁): Normally, after maximal inspiration, at least 80% of the volume is expired again within 1 sec (black curve). With asthma and exercise-induced asthma the volume expired out in 1 sec is decreased (red curve).