Cortisone in football – blessing or curse?

What are glucocorticosteroids?
Hormones produced in the adrenal cortex are described as corticosteroids. Glucocorticosteroids represent a sub-group whose name indicates their main effect: carbohydrate metabolism. They stimulate a process called gluconeogenesis, meaning sugar or glucose formation mainly from protein. The most significant glucocorticosteroid in the body is cortisol. Synthetic glucocorticosteroids are often called cortisones.

Action of glucocorticosteroids
Cortisone affects our metabolism by affecting how glucose is formed through the break down of proteins. In addition, it affects fat metabolism leading to an increased formation of free fatty acids. The most important effects on the electrolyte balance are that sodium and water are retained by the body while potassium is increasingly eliminated. Finally, the glucocorticosteroids are of crucial importance for life-saving stress reactions.

<table>
<thead>
<tr>
<th>Systemic Application</th>
<th>Local Application</th>
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</thead>
<tbody>
<tr>
<td>Rheumatic and other inflammatory diseases</td>
<td>Traumatic, inflammatory and degenerative joint diseases (Injection into the joint)</td>
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<td>Tendines (e.g. musculo-tendinous insertion pain, tendosynovitis)</td>
<td>Spinal diseases</td>
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<td>Allergic diseases (e.g. allergic reactions to medicine, anaphylactic reaction)</td>
<td>Skin diseases (incl. allergic reactions)</td>
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<td>Asthma diseases</td>
<td>Asthma diseases (inhalative)</td>
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<td>Intestinal diseases (e.g. Crohn’s disease, ulcerative colitis)</td>
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<td>Malignant diseases</td>
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<tr>
<td>Diseases of nervous system</td>
<td>Diseases of the eyes, nose and ears</td>
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</table>

Table 1 Indications for glucocorticosteroids - selected examples
The broad therapeutic use of cortisone (Table 1) results from its anti-inflammatory effects. The early development of edema as well the growth of connective tissue are inhibited. In sports injury and overuse, inflammatory reactions lead to pain. Local cortisone injections inhibit this inflammation process and thereby help to relieve pain. For some internal and general medical illnesses, cortisone belongs to the standard drug therapy. With competitive and top-class athletes, cortisone treatment can be indicated for allergies or diseases of the intestine, skin and eyes (Table 1). In asthmatic diseases, inhaled corticosteroids are part of basic treatment.

**Unwanted side-effects**

Glucocorticosteroids can be administered as injections, tablets, drops, solutions, suppositories, sprays, ointments or creams. Inhalation treatment, such as for asthma, seems to produce few side effects. In principle, even with local use, absorption into the blood can lead to the whole spectrum of side-effects caused by systemic use has always to be considered. The frequency of unwanted effects correlates with the duration and dose of treatment. Table 2 lists a selection of important side effects, particularly regarding sports. Inhalation treatment, such as for asthma, seems to produce few side effects.

- Adrenocortical insufficiency
- Cortisone withdrawal symptoms
- Cushing’s disease
- Diabetes mellitus
- Myopathy (muscle weakness)
- Osteoporosis
- Wound-healing disorders
- Loss of potassium
- Risk of infection
- Gastric and duodenal ulcers
- Psychic disturbances
- Overuse injuries
- Skin damage

Table 2 Side-effects of glucocorticosteroids
The production and release of glucocorticosteroids within the body is controlled by a feedback mechanism involving specific parts of the brain. After systemic cortisone treatment, production by the adrenal glands is decreased due to the inhibition of this automatic control loop system. This leads to a temporary insufficiency of the adrenal cortex. Therefore, if the cortisone treatment is suddenly stopped, exhaustion to the point of collapse in stressful situations can occur. Furthermore, withdrawal symptoms can develop with fever, joint and muscular pains as well as a general feeling of sickness.

Due to the formation of glucose, diabetes can develop or worsen. The amount of protein is reduced particularly in the muscles, bone and skin. Myopathy can cause muscle weakness, in particular of the upper arms and thighs as well as the shoulder girdle and pelvic area. In addition, back pain, a reduction of the bone mass which may lead to fractures, disturbances of wound healing or atrophy of the skin can occur.

The anti-inflammatory effect and the weakening of the immune system increase the risk of infection. Gastric and duodenal ulcers are primary side-effects in the digestive tract and should be taken seriously. Insidiously developing bleedings and perforations are particularly feared. A well known complex of symptoms is "Cushing’s Syndrome" with acne, weight gain, water storage and high blood pressure. Cortisone can also lead to psychological problems like nervousness, sleep disturbance, listlessness, euphoria and psychosis.

The risk of infection always exists when injecting into a joint. Tendon ruptures can occur when repetitive, local pain injections are administered after sports injuries. The local application e.g. as cream can cause damage to the eyes and skin with skin atrophy and acne.

**Cortisone and doping**

All glucocorticosteroids are prohibited in competition whether administered orally, rectally, intravenously or intramuscularly. Their use requires a Therapeutic Use Exemption (TUE) approval. For non-systemic application (e.g. injections into the joints or inhalation in asthma therapy) an abbreviated Therapeutic Use Exemption, which is more a notification at the time of application, is required. Topical preparations for skin (e.g. ointments and creams), ear, nose, buccal cavity and eye disorders are not prohibited and do not require any form of Therapeutic Use Exemption. The manner in which the active substance was administered cannot, however, be differentiated by urine analysis. In case of a doping test, the laboratory cannot distinguish between systemic and non-systemic application.

How fast an active substance is broken down or excreted from the body - its biological half-life - is of considerable importance with regard to doping controls. Between short and long-acting glucocorticosteroids, all gradations exist, with some being traceable for several weeks after the last application. In order to protect the athletes, it would be most advisable to start the TUE application procedure even if the local injection took place weeks before the match even though usage is not prohibited out of competition.

**Does cortisone enhance performance?**
For decades, systematic glucocorticosteroids have been abused to enhance performance and they once belonged to the class of the most widely used doping substances in sports. Athletes took them also to lessen pain and reduce tiredness, ignoring the possible adverse effects. Nevertheless, performance-enhancing effects of glucocorticosteroids are disputed and have not been proven by scientific data. An euphoric effect has been discussed as a possible mechanism for influencing performance, but the catabolic effects of long-term use can be unfavourable. Other matters of debate are a possible increase of cardiovascular performance and an improvement of maximal performance, however, neither effect has been scientifically corroborated.