Corticosteroids – the good, The bad and the ugly

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Preamble

Cortisone is a naturally occurring steroid hormone made from cholesterol in the adrenal glands. It affects most tissues and organs in our body, especially by regulating the activities of several enzymes. Together with adrenaline, another hormone secreted from the adrenal glands, cortisone plays a major role in the stress reaction, more commonly known as the ‘fight or flight’ response.

Synthetic cortisone and related glucocorticoids are used clinically as potent anti-inflammatory agents by suppressing the immune system. As a result, it exerts an anti-inflammatory action, and reduces any pain and swelling. Cortisone and related corticosteroids are very potent drugs, and predictably are prone to numerous adverse reactions, or side effects. There are significant risks which go with the long-term use of cortisone, etc., especially at high doses given by injection. One of these is cortisone abuse.

In this review the natural roles of cortisone in our body will be explored, and how the pharmacological action of synthetic cortisone is accompanied by a range of substantial side effects. The nature and consequences of cortisone abuse will also be presented.

What is cortisone?

Each adrenal gland lies on the upper surface of both kidneys. It is a double organ, made up of an inner medulla, and an outer cortex. In response to stimulation by the pituitary gland in the brain, the cortex secretes into the bloodstream several steroid hormones: the mineralocorticoids (like aldosterone); the glucocorticoids (like cortisone); and some sex hormones. Both the mineralocorticoids and the glucocorticoids (the corticosteroids) are essential for life. They influence many organs and body structures. This review is concerned only with the glucocorticoids.

There are several glucocorticoids secreted from the adrenal cortex. The most prominent one is cortisone, although chemically related hydrocortisone, cortisol, prednisone, and prednisolone appear in the mix.
Cortisone etc are completely different to another group of steroids called the anabolic steroids, which have gained notoriety because of abuse by some body builders and athletes.

**What is cortisone’s role in the body?**

Cortisone has many important functions in the body, and influences virtually every organ system. Cortisone is in fact termed a stress hormone; it has a strong role in the body’s mechanisms for dealing with stress. Stress may arise from many sources, ranging from fear, anxiety and various disorders, to sudden changes in temperature and bodily damage from trauma or surgery.

When in a stressful situation, cortisone helps move glucose from the tissues where it is stored into general circulation in order to provide extra energy for essential tissues like the heart, skeletal muscle, and the brain – the parts of the body directly involved in the “fight or flight” syndrome.

**The ‘fight or flight’ response**

This is our body’s basic, inborn and automatic survival response to possible bodily harm or attack. It rapidly prepares us to either stand our ground and fight, or flee from a threat. When we are exposed to excessive stress, either from external sources, or arising from internal fear or worry, a physiological reflex is triggered. This reflex is ‘hard wired’ into our nervous system, especially our brain, and our endocrine system, particularly the adrenal glands. It is part of our genetically determined wisdom of the body, recognised in Tibb as Physis.

When this stress response is activated, nerve messages are issued from part of the brain, firstly the amygdala, then the hypothalamus, then the pituitary gland which travel to the adrenal glands. These in turn are stimulated to release hormones, mainly adrenaline (from the medulla part of the gland), and cortisone (from the cortex part). These hormones bring about a series of rapid and dramatic changes to the body. The first one is an immediate rise in the breathing rate, followed quickly by a rise in blood pressure and blood sugar is mobilized from the liver. This creates the energy reserve which may be used at short notice. Moreover, blood is diverted from where it is not needed, such as the digestive system and liver, to areas where it is, especially the skeletal muscles in the limbs. The body is thus better equipped for fighting or fleeing.

Not only that, but our pupils dilate, so improving our vision markedly. Our general awareness sharpens, our sense of pain deadens, and our general bodily impulses speed up.

More slowly, our immune system, an essential part of Physis, goes into active mobilisation, so expecting a real need for tissue repair, whether from fight or flight.

Once the threat has passed, then the cortisone continues to act to replenish the depleted energy stores in the liver. As part of this process, the person’s appetite is increased, so stores of fatty tissue, which have been run down to provide energy during the stress episode, are rebuilt. This
can lead to substantial weight gain. Cortisone secretion then fall offs, and the body's parasympathetic system takes over the role of restoring normality.

**Physis, stress and cortisone**

Tibb associates abnormal or long lasting stress with the qualities of heat with dryness. There is a serious imbalance in these qualities, which occurs as a reaction to any physical, mental or behavioural factor which is beyond the person's ability to control. This explains the primary symptoms of panting and increased heart rate and, and secondary symptoms such as diarrhoea. We now know these are due to the effects of the stress hormones adrenaline and cortisone. It also explains why people who are bilious in temperament, especially dominant, but also sub-dominant, who have dryness as a major quality, are more susceptible to the negative effects of continued stress.

Tibb views good health as the outcome of harmony between the person's temperament, the lifestyle he or she has adopted, and the environment. When there is disharmony due to excessive stress, then the body is under a serious health threat. This can arise in the immediate outside, environment: physically threatening situations from, for example, exposure to crime and dangerous driving, can bring on acute stress very quickly. It can also arise from within: anxiety over money problems, divorce, job loss, etc., will lead inevitably over the longer term to chronic stress.

To deal with either form of stress the body attempts to restore harmony by bringing *Physis* into operation. To deal with either form of stress the body attempts to restore harmony by bringing *Physis* into operation. Physis calls on and regulates a wide range of mechanisms to restore qualitative balance These include stimulating the secretion of the stress hormones, adrenaline and cortisone, the mobilisation of energy-providing glucose from depot tissues such as the liver, and the conversion of fatty acids into glucose.

**Clinical uses of cortisone**

Cortisone is used clinically in three distinct areas:

1. Replacement therapy for a failing adrenal cortex.
2. As a drug for a wide range of inflammatory diseases.
3. To prevent organ rejection after transplantation.

1. **Replacement therapy.** If a person's natural level of cortisone is too low because the adrenal cortex glands are not working properly, serious problems will arise. This form of adrenal insufficiency occurs in Addison's Disease and sometimes after surgery. The person affected will succumb to fatigue, general weakness, a range of digestive disorders, and joint and muscle pain. More seriously, it can lead to collapse and even death. This clinical emergency is treated by replacement cortisone therapy, in order for the body to function normally once again.

2. **Treatment of inflammatory diseases.** Cortisone and related glucocorticoids are routinely used in a very wide range of clinical disorders. They are administered either locally (on skin) or oral tablets or by injection into the skin, muscle or other tissues.
Their use falls into two distinct areas:

- In disorders where there is excessive inflammation
- To suppress the immune response

The main clinical applications are summarized in the table below:

<table>
<thead>
<tr>
<th>Medical Category</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rheumatic disorders</td>
<td>Inflammation of a joint, tendon, cartilage or bursa – rheumatoid, psoriatic, gouty and osteoarthritis, bursitis, gout</td>
</tr>
<tr>
<td>Breathing disorders</td>
<td>Acute or chronic inflammation of the breathing passages – Bronchial asthma, pneumonia, tuberculosis, severe sore throat</td>
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<tr>
<td>Allergic states</td>
<td>Acute asthma attacks, contact dermatitis, serum sickness</td>
</tr>
<tr>
<td>Skin diseases</td>
<td>Resolving scars, suppressing eczema, psoriasis, urticaria, drug reactions, fungal infections, hives, sarcoidosis, shingles</td>
</tr>
<tr>
<td>Disorders of the digestive system</td>
<td>Ulcerative colitis, Crohn’s disease, enteritis, sprue</td>
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<tr>
<td>Endocrine disorders</td>
<td>Thyroiditis, adrenal cortex insufficiency</td>
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<tr>
<td>Disorders of the blood forming system</td>
<td>Anaemia of different origins, purpura</td>
</tr>
<tr>
<td>Diseases of the eye</td>
<td>Keratitis, eye ulcers, iritis, uveitis, allergic reactions, shingles</td>
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<tr>
<td>Certain cancers</td>
<td>Certain leukaemias and lymphomas</td>
</tr>
<tr>
<td>Immune suppression</td>
<td>Autoimmune diseases, after an organ transplant</td>
</tr>
<tr>
<td>Various</td>
<td>Tried in lupus, heart &amp; kidney inflammation, multiple sclerosis flare-ups</td>
</tr>
</tbody>
</table>

3. Organ transplantation. Following the transplantation of a solid organ like the kidney or liver from one person (the donor) to another (the recipient), Physis recognises the new tissue as being foreign to the person, and sets up a powerful response to eliminate the alien intruder. It does this by mounting a complex rejection process, involving severe inflammation at both the tissue and the cellular level. Corticosteroids, natural and synthetic versions, are often used to suppress this rejection process. They are part of a cocktail of drugs, including methotrexate, cyclosporine and several others which dampen down the rejection process. If successful, the transplant takes hold in the recipient’s body, and begins to function properly. However, maintenance treatment with low doses of cortisone is necessary in order to prevent a flare-up of the rejection episode, possibly for many years.

Adverse effects of cortisone

Cortisone and its related corticosteroids are powerful pharmacological agents. They have a huge impact on the inflammatory and immune system mechanisms, which are immensely important aspects of Physis. It comes as no surprise, therefore, that they are prone to many serious, often devastating, adverse reactions or side effects.

People taking cortisone at high doses, or for an extended period of time, are prone to one or more of the following side effects:
• **Digestive system upset.** Ulcers in the oesophagus and stomach are common with long term cortisone usage, as is inflammation of the pancreas. Persistent nausea and abdominal distention may occur.

• **Reduced resistance to pathogenic microbes.** People’s immune system is weakened, so making them more susceptible to coughs and colds, brought on by certain viruses, to fungal infections like thrush, and to general bacterial infections. The cortisone may also mask the signs and symptoms of an infection, making them deceptively trivial.

• **Diabetes.** Long-term cortisone use (or abuse) raises blood sugar levels. It can, therefore, makes diabetes more difficult to control. Prolonged use often causes a condition known as steroid-induced diabetes in patients who were not diabetic or were borderline diabetic beforehand. In some users cortisone also reduces the effectiveness of insulin, so blood levels of glucose rise.

• **Wound healing.** This takes much longer than normal after surgery or trauma, and the possibility of opportunistic infections increases.

• **Atherosclerosis.** The arteries may harden, partly because of an increase in blood sugar and fats. A rise in blood pressure will also contribute, due to water and sodium retention.

• **Osteoporosis.** Thinning of the bones, making the hip and spine especially more susceptible to fracture. This can be aggravated by progressive skeletal muscle weakness.

• **Physical appearance.** The face becomes flushed, with swollen cheeks, leading to the typical ‘moon face’. An increase in appetite can lead to a rapid and evident increase in body weight. This is aggravated by water retention in the body. Abnormal fat deposits form on certain parts of the body – face, chest, back, and abdomen.

• **The skin.** This becomes thin and very fragile, bruising easily. Stretch marks form on the skin at different sites, and acne or pimples appear. Cataracts may develop.

• **Suppressed growth.** This often appears in children, so they are physically smaller than they should be at a certain age.

• **Behaviour problems.** People can become irritable for no real reason, or conversely irrationally euphoric. Temper tantrums and the typical ‘steroid rage’ may occur. Sudden changes in mood are common, as is depression. Insomnia can become a problem.

• **Others.** Headaches, dizziness, cataracts, glaucoma, can occur in long-term cortisone intake.

There are also a number of other problems associated with long-term, high dose cortisone usage:

• **Drug dependency.** Once a pattern of regular use is established, people find it very difficult to discontinue. The original target ailment generally relapses. Cortisone abusers usually battle to discontinue, and this brings certain problems of their own.
- The rebound effect. Many people using cortisone effectively for a particular condition find that it flares up once it is withdrawn. This often results in a return to the cortisone treatment, perhaps at a higher dose.

- Adrenal suppression. During long-term cortisone treatment the adrenal glands gradually shut down secretion. If the cortisone is discontinued suddenly, then the adrenal cortex is unable to resume secretion immediately. This means the person is more exposed to stress, and less protected by natural cortisone secretion.

The abuse of cortisone

The regular use, and abuse, of cortisone and its structural relatives is common in many athletes, especially cyclists, as it suppresses pain. This allows the cyclist to go through the pain barrier, so improving personal performance. Many professional cyclists and other athletes used cortisone injections heavily in the past, especially at a time when testing was not as draconian as it is now. It was the preferred drug of choice in many endurance sports. In fact, cortisone injections were regarded as routine, even commonplace.

However, cortisone abuse does carry a substantial risk. Their over-enthusiastic intake can backfire spectacularly, with possibly catastrophic consequences. Over time, the artificial stimulation of damaged muscle leads to a progressive weakening of not only the muscles, but the joints they service. When taken at increasingly higher doses, the adverse effects can begin to outweigh the supposed benefits. To start with, headaches, sudden visual disturbances and physical weakness may appear. An abnormal and alarming rapid heartbeat and difficulty when breathing may develop. These symptoms may be followed by the appearance of blood in the stool, a sign of marked internal bleeding. These reactions often require emergency care.

Summary

Cortisone and its related steroid hormones are produced from cholesterol in the two adrenal glands located on top of each kidney. It is released in response to normal everyday such as waking up in the morning, exercising, and handling stressful situations. In addition, it is, together with its partner adrenaline, the hormonal agent responsible for the ‘fight or flight’ survival response. Cortisone floods the body with glucose, supplying an immediate energy source to large muscles. In addition, cortisone inhibits insulin production, so that glucose is available for immediate use rather than for storage.

Cortisone has multiple, far-reaching systemic effects, playing many roles in the body’s effort to carry out its routine processes, maintain internal metabolic harmony or homeostasis, and deal with threats from the person’s physical, emotional and social environment.

When taken as a supplement for various reasons, the immediate effect on pain relief, muscle growth and immune suppression may be dramatic. However it is not long lasting, and leads with repeated usage to a number of adverse effects.
Further reading

Roles of cortisone. Online at: www.todaysdietitian.com/newarchives/11609p38.shtml

Effects of elevated cortisone levels: www.todaysdietitian.com/newarchives/111609p38.shtml

Stress and its management. Online at: www.tibb.co.za/ailments.html

Physis. Online at: www.tibb.co.za/concepts_tibb.html
www.tibb.co.za/research_reviews.html

Tibb Theory & Practice. Online at: www.tibb.co.za/pub_articles.html