

" β -receptor-blocking and fitness for flying, especially for glider-pilots in competition"

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We flight surgeons all know that psychically strenuous situations lead to an additional catecholamine excretion. This induces, among other things, a considerable increase of the heart-frequency in the sense of a so-called stress-tachycardia and can sometimes even cause extrasystoles.

Because of their special constellation, pilots are subjected to emotional strain that can cause the heart-frequency to increase by more than 200 beats a minute, and as I just mentioned, can cause extrasystoles to appear. Clasing, Rujbr and Stedtfeld, and Keul and his co-workers have repeatedly reported this since 1971.

As a flight surgeon one must consider whether or not such adrenergic-caused cardiac symptoms disturb the fitness for

flying immensely. If the severe tachycardia is of organic origin and one must assume rhythmic disturbances, fitness for flying is of course completely impossible. In other cases, one must find a remedy that reduces or even eliminates such disturbances, especially for pilots whose cardiologic results are otherwise absolutely normal, and whose pulse and blood pressure also remain normal when they are subjected to 200 watts on the bicycle-ergometer and for whom furthermore no extrasystoles or hypoxaemic signs are observed.

At the International Congresses of Aviation and Space Medicine at Helsinki in 1977 and at Manila in 1979 I reported among other things, that special physical endurance training and a modified autogenous training according to I.H. Schultz can help reduce some of the previously described symptoms. But this can only be achieved to a certain degree.

Thus one is confronted with the question of using specific effective medication; here I mean so-called β -blockers that are surely well known to all of you. In the past years β -blockers have often been used for athletes, for racing motorists and also for pilots. However, as a flight surgeon I don't have to tell you that one should be very careful in giving medicine to pilots.

Aschoff, Grunhofer, Lomonaco, Kiese-wetter and co-workers and Schulte-Wintrop have reported in detail on this. Among other side-effects the disturbances of the vigilance, performance and capacity for reaction and of central-nervous functions play an important role. Also changes in the haemodynamic conditions must be taken into account. So only medical treatment, that does not have a negative effect on these factors should be given.

Now let me remind you of the way in which the β -blockers operate. β -receptors are so-called "receiving-stations" of the cells, that receive impulses from the sympathetic steering-system with the help of transmitting substances noradrenalin

and adrenalin. The latter are structured in such a way, that they can combine with the β -receptors. If, however, a false transmitting substance of affinity but without information is offered, the β -receptor is blocked and the cells cannot react. As you know, there are two kinds of β -receptor-blockers, the β_1 - and the β_2 -types. The β_1 -blockers are cardioselective, that means, they have a so-called cardiodepressive effect. In general they can be applied when there are functional sympathetic disturbances of the heart or circulatory system, and they have a positive effect. By stopping the rapidly shooting β -adrenergic stimulation in front of severe tachycardia, and sometimes also arrhythmus, one can penetrate the almost endless circle of psychic-stress, the wasteful increase of heart-beating fear-stress.

Again and again we flight surgeons are faced with the important question of how strong the side-effects really are, especially concerning the central nervous system and haemodynamic influence the above mentioned authors have researched this problem. A large number of β -

blockers have been tested on double-blind-cross overtest. The research has proved that the application of atenolol in connection with the special problem discussed in this report is not only favourable, but even leads to an improvement of the ability to concentrate and react, without a disturbance of the vigilance, performance or capacity for reaction. This fact has been emphasized by Keul, Harms, Nechvatal and Moser. At the 8th European Cardiologic Congress at Paris 1980 Harms and Nechvatal reported these studies and pointed out that the time it takes persons treated by the β -blockers to react is significantly shorter than the time required for those receiving placebo-treatment. In one of their studies Bonn, Turner and Hicks proved that cardioselective β -receptor-blockers are scarcely translated in the cerebral-liquor and have no effect on the central nervous system. Also Cruickshank, Neil-Dwyer, Cameron and McAinsh reported that atenolol, which is water-soluble and has the least lipophilicity, is hardly enriched in the brain-tissue. For this reason the application of the atenolol β -blocking does not disturb the vigilance, performance or capacity for reaction; in particular it does not reduce the fitness for flying or for driving.

Further studies done by Keul, G. and H. Huber, Zöllner and Sielberger showed that, in addition to the above effects, especially the improvement of the capacity for driving cars, the increased glucose-glycerin and free fat acid level

under hyperadrenergic conditions are significantly decreased. The normal initial values are not changed. Neither are lactate, neutral fats, cholestrin, somatotropin or insulin.

Simpson pointed out, that orthostatic irregularities do not appear. During the studies, Simon, Dickhut, Lindscheidt, Kindermann and Keul noticed that in a state of calmness practically no changes can be observed, whereas a strenuous situation leads to a remarkable decrease in

the heart-frequency and the systolic blood-pressure. Furthermore I should mention that atenolol is not metabolised; 95% of it is excreted through the kidneys.

Hollmann, Liesen, Rost, Heck, Mader, Philippi, Schürch and Kawahats from the German University for Sports in Cologne emphasize that β -receptor blocking cannot be compared with "classical doping", that is taking medicine shortly before or during a match, contest, race or competition to mobilise physical or mental strength beyond what can be obtained by free-will.

Of course in this report I should also talk about side-effects or counter-indications. β -blockers should not be given to pilots, who are fit for flying, but have a "bradycardia", because a further slight decrease in the heart-frequency might seem unbearable to them. If a person has been treated with β -blockers for a substantial period of time, the treatment should not be ended abruptly. In the beginning as in the end the haemodynamic conditions must be stabilized slowly. There are no counter-indications for pilots, who are fit for flying.

To conclude this report I should like to say, that atenolol is marketed in Germany under the name "Tenormin". It can be given once a day in very small amounts of tablets containing 50 or 100 mg. This of course requires that the pilot is properly adjusted to the β -receptor-blockers, that he has become well acquainted with it and that the haemodynamic conditions are stable.

Zusammenfassung

In diesem Referat wird aufgezeigt, dass nach vielfachen Arbeiten unterschiedlicher Autoren eine deutliche positive Beeinflussung eines durch nervliche Übererregbarkeit entstandenen Herzsyndroms mit erheblicher erhöhter Pulsfrequenz, Bluthochdruck und psychovegetativ ausgelösten Extraschlägen bzw. Rhythmusstörungen des Herzens durch Beta-Rezeptoren-Blocker erfolgt, ohne dass Parameter wie Aufmerksamkeit, Gesamtverhalten oder Reaktionsfähigkeit gemindert werden, im Gegenteil eine diesbezügliche günstige Einstellung erfolgt.

Es wird erläutert, dass speziell der β -Blocker Atenolol im Hirngewebe praktisch nicht angereichert wird, dass Regulationsstörungen in Form von Durchblutungsstörungen mit Schwankschwindelgefühl nicht beobachtet wurden, ein unter überschüssiger nervlicher Beeinflussung erhöhter Traubenzucker-, Glycerin- und freier Fettsäurespiegel signifikant gesenkt wird, wogegen normale Ausgangswerte nicht geändert werden, ebenso nicht Milchsäure, Neutralfette, Cholesterin, Somatotropin und Insulin beeinflusst werden. (Es handelt sich hierbei um Stoffwechselprodukte im Organismus bzw. um das für den Traubenzuckerstoffwechsel erforderliche Insulin der Bauchspeicheldrüse.)

Es wird darauf hingewiesen, dass nach den Ergebnissen der Sporthochschule Köln Beta-Rezeptoren-Blocker nicht unter das Doping fallen.

Nebenwirkungen entstehen bei fliegertauglichen Piloten praktisch nicht, wenn man von einer Beta-Rezeptoren-Gabe bei stark ausgeprägter verlangsamter Pulsfrequenz in Ruhe absieht.

Abschliessend wird festgestellt, dass ein Beta-Rezeptoren-Blocker wie Atenolol, zunächst unter Kontrolle angewandt, bei anhaltendem subjektivem Wohlbefinden und stabil bleibenden Kreislaufverhältnissen bei der geschilderten Anzeigestellung angewandt werden kann und sollte.