EXAMINATION OF THE EFFECT OF G-LOAD ON CARDIOVASCULAR SYSTEM BY HOLTER METHOD

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The longitudinal ECG observation was worked out by Holter /1/ in 1961, then in 1979 it was so revised by Fletcher /2/ that today it is a popular, informative examination method of cardiology. It has an essential role in diagnostics of arrhythmias and ischaemic changes but even in diagnostics of repolarisation disturbances. The aim of our examinations was to state whether can the cardiovascular changes -arising during trick-flying under the influence of g-load- be followed by Holter method. Our other aim was to verify the importance of this method in prevention of exhaustion state /4/.

Our investigations were performed in 3o healthy fighting pilots, and 11 such fighting pilot who showed some cardial disturbance -in most instances extrasystoles- during the annual control. The average age of the examined persons was 4o,5 years (26-51 years).

Fig. 1

Fig.1 shows the recorder placement in MIG-21 plane. This disposal is satisfactory in flying security respect for on the one hand it does not disturb the

pilot's manual activity, on the other hand it does not influence the safe leaving of the plane in case of an accidental ejection /5/.

Fig. 2

In Fig.2 the placement of the electrodes can be seen. For Kenedy's proposal /3/ (1976) we used bipolar leads. By the used MX-DS leads we made an informativ and disorder free electrocardiogram.

Fig.3

The evaluation of recording was done by Del Mar Avionics computerized device, shown in the slide. The data of the black box, evaluated in a needed extent for us and graphically illustrated, gave us an indispensable help in it.

Results

Fig.4

With this method, the changes of pulse rate can be followed well during the different flight periods. As it can be seen, much more higher pulse rate can be measured during the critical flight phases /eg. taking off, trick-flying, landing/ than before flight and after flight.

Fig.5

In this figure the relationship between the magnitude of g-load and pulse rate is performed. We have found that the pulse rate parallelly increases

with the increase of g-load, and after its ceasing it returns to normal within 1 minute.

Fig. 6

We have compared the experienced trainer pilots' and the young candidates' pulse rate changes during trick-flying, in different phases of flight. We have noticed that throughout the flight the trainers' pulse rate is lower than that of candidates, except for the phase of trick-flying, when the situation is reversed. It can be explained by the fact that the trainers are exposed to a higher psychic and physical load in the back seat of the trainer (UTI) plane during this flight situation.

In those 3o persons - who were suitable for flight without any deviation- we have not noticed ECG deviation, even during g-load.

In Fig. 7 the deviations are performed, found during real flight, in the 11 pilots with cardiological problems.

Fig. 7

It can be seen that the ECG deviations improved in 5 persons during the institution examination or rather the problem disappeared during flight, in 4 persons those remained unchanged, while those worsened in 2 persons. Otherwise these 2 persons became prohibited.

It should be noted that the deviations, found in these pilots' Holter ECG during simulator flight, were essentially unchanged.

On the basis of our examinations we can state that Holter monitoring is a correct, exact method for the observation of cardial changes during flight for it gives an overall picture of the dinamic changes of the cardiac action during flight stress. At the same time it provides great help even in judgement of aptitude for flight, as those pilots whose ECG improved during flight or whose earlier changes disappear, can be reliably reinstated.

REFERENCES:

1. Holter, N.J. New method for heart studies: continuous electrocardiography. Science., 134, 1214, 1961.
2. Fletcher, G.F. Dynamic electrocardiographic recording. Futura Publishing Company, 1979.
3. Kennedy, H.L. et all. Practical advantages of two-channel electrocardiographic recordings. Am. Heart J. 91, 822, 1976.
4. Kvareczky, Klossovsky: Fiziologicseszkie korrelati lotnoj nagruzki. Problemi Kosmiceskoj Biologii, 1962, 64.
5. Remes P., Hideg J., Pozsgai A.: Reális repülés alatti Holter-monitorozással szerzett tapasztalatok. MNOTT 1988. évi Repülőorvosi Szekció ülésén elhangzott előadás.

FIG.1

THE CHANGE OF PULSE RATE IN DIFFERENT PHASES OF FLIGHT

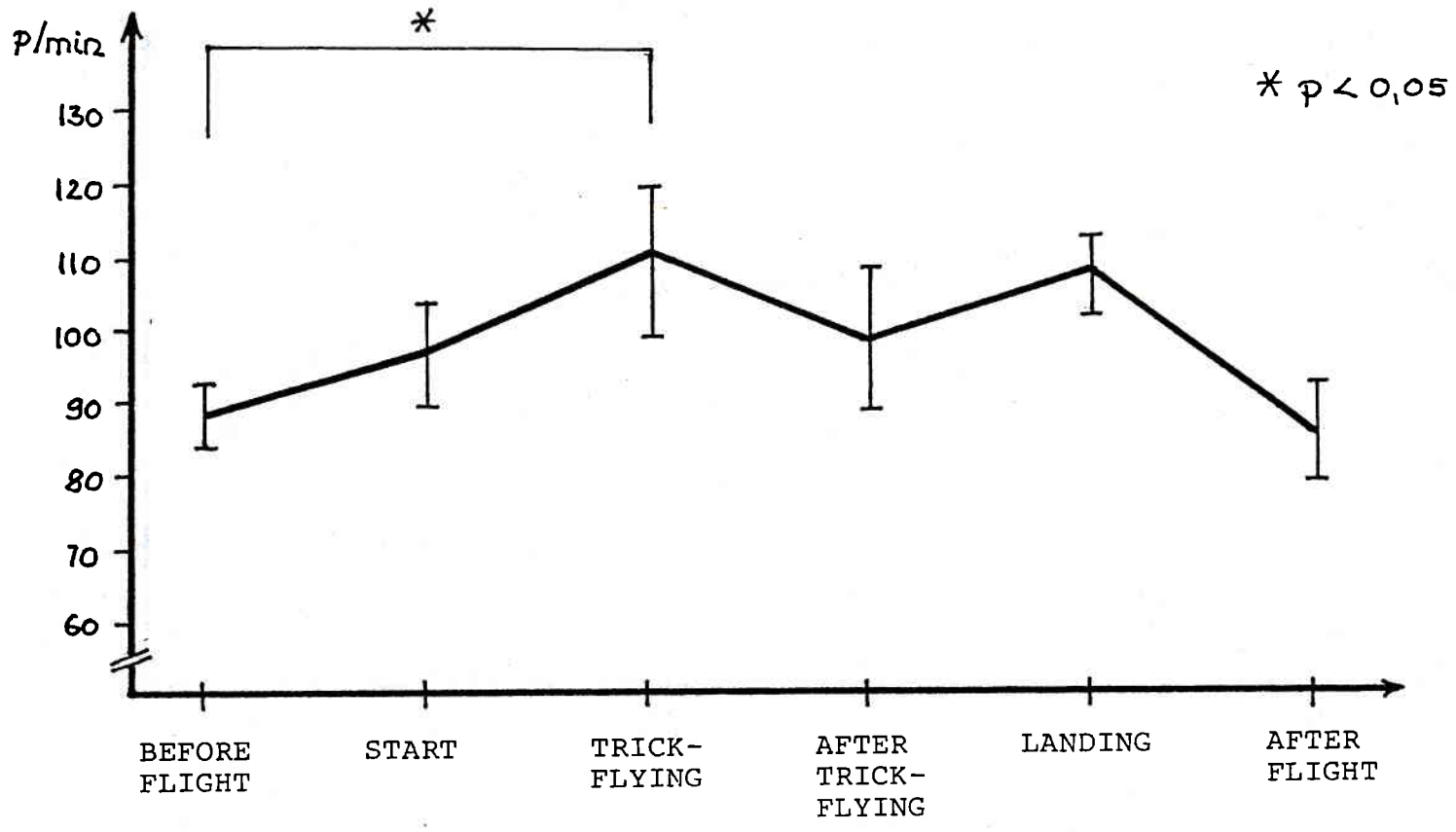

FIG.2

THE CHANGE OF PULSE RATE TAKEN AS A FUNCTION OF G-LOAD

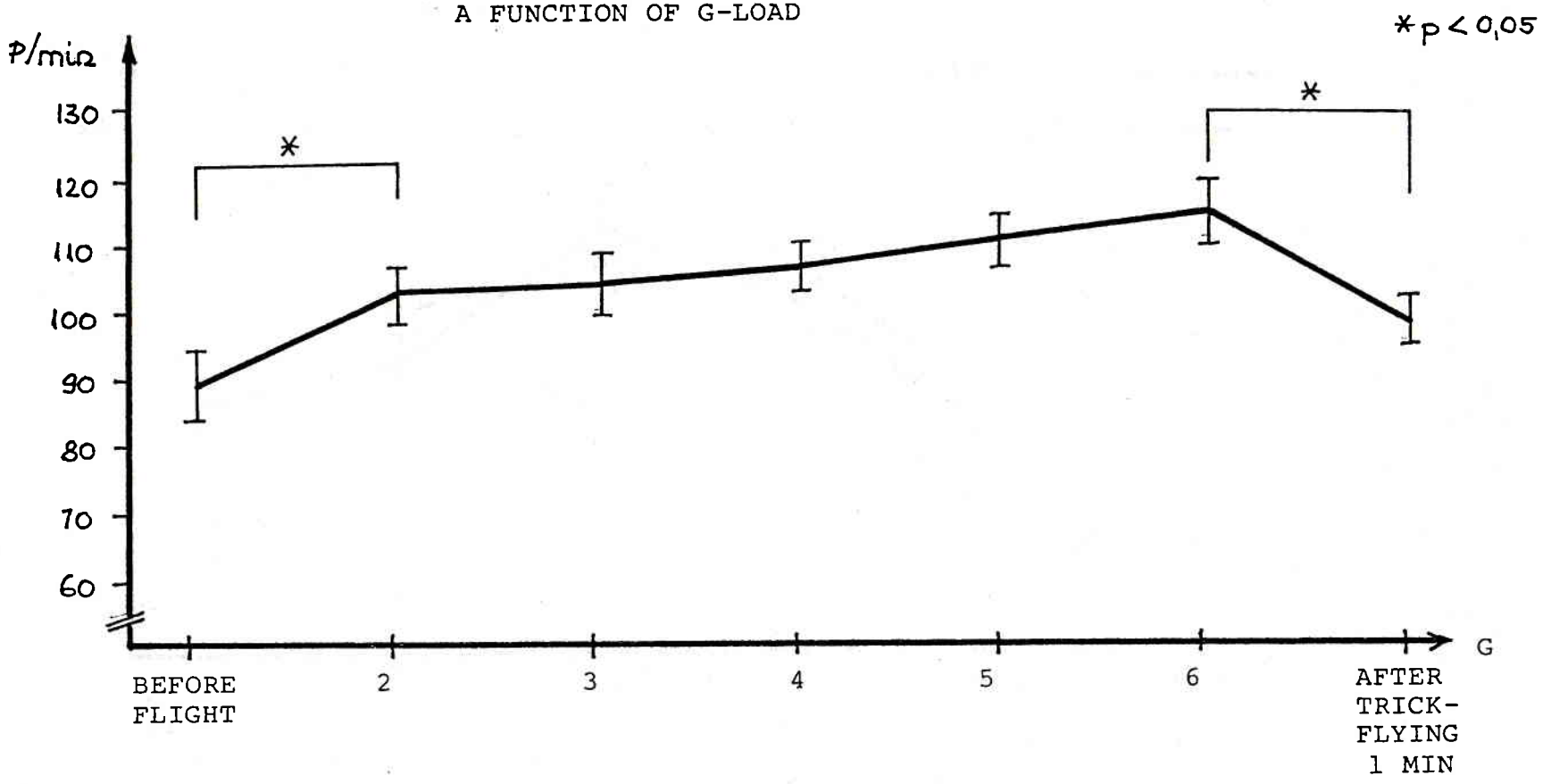

FIG.3

THE TENDENCY OF TRAINERS' AND CANDIDATES' PULSE RATE

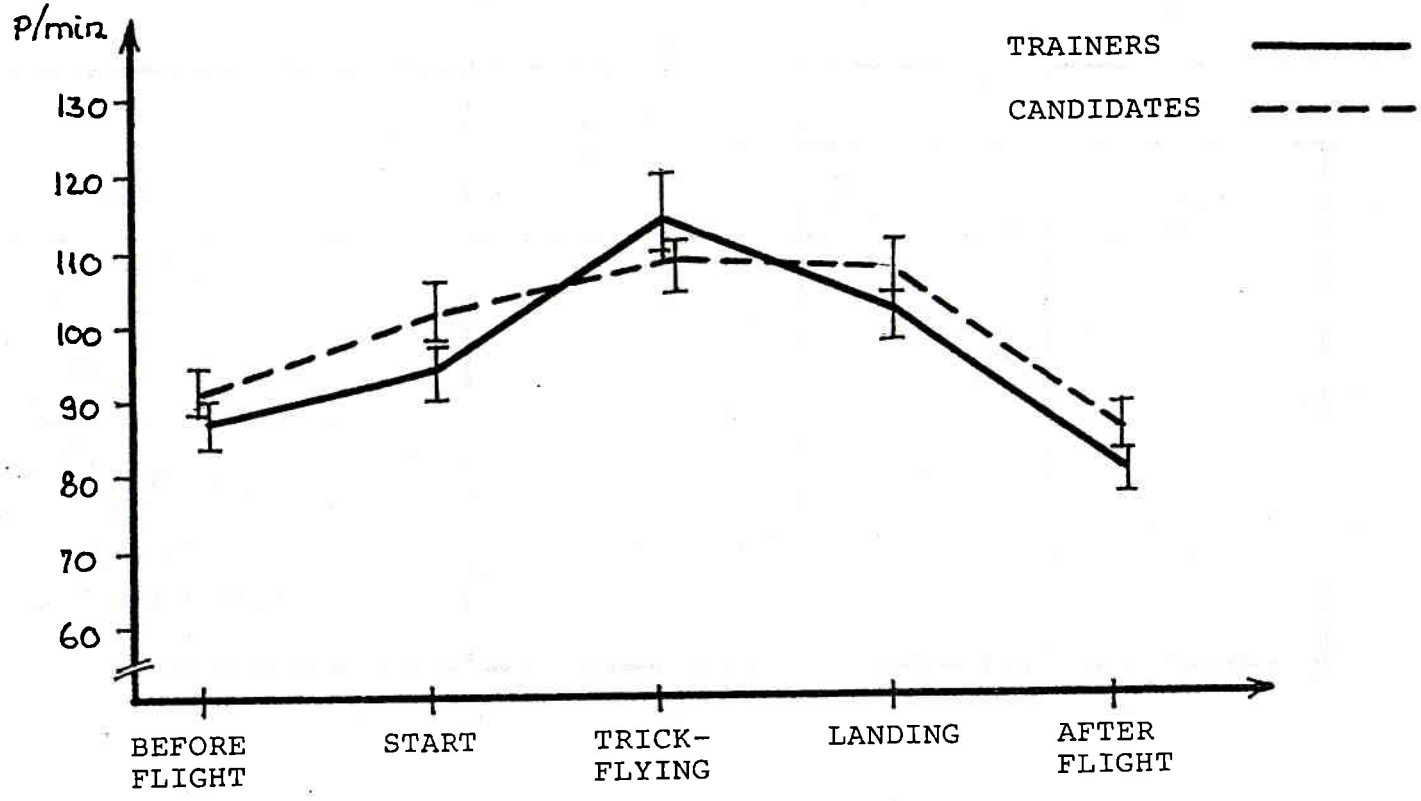

FIG.4

ECG CHANGES IN PILOTS WITH CARDIOLOGICAL DEVIATIONS DURING FLIGHT

DAMAGE	DURING GENERAL EXAMINATION	DURING FLIGHT		
		WITHOUT CHANGE	IMPROVED	FAILED
VENTRICULAR EXTRASYSTOLE	6	2	3	1
EXTREME SINUS TACHYCARDIA	1	1	-	-
SICK-SINUS AFTER ELECTRIC SHOCK	1	-	-	1
IMPULSE CONDUCTION DISTURBANCE	1	-	1	-
LOADING REPOL. DISTURBANCE	2	1	1	-