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ANALYSIS OF THE RESULTS OF QUALIFYING TESTS FOR CANDIDATES TO THE SECONDARY AVIATION SCHOOL IN DĘBLIN

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Background: This report describes the results of medical examination of candidates to the Polish secondary aviation school. The total population consisted of 156 adolescents, including 28 females and 128 males. A total of 83 candidates (53.2%) of the population were considered fit, including 19 females (22.9%) and 64 males (77.1%). A total of 73 candidates (46.8%) of the population were considered unfit, including 9 females (12.3%) and 64 males (87.2%).

BACKGROUND

The F. Żwirko and S. Wigura Secondary Aviation School in Dęblin (OLL) is the only secondary school in Poland that acts as a stepping stone for aviation careers of its alumni. The next step up the ladder are studies at the Polish Air Force Academy (PL: Wyższa Oficerska Szkoła Sił Powietrznych, WSOSP) – a breeding ground for future military pilots.

Besides obligatory courses provided by every secondary school, the Secondary Aviation School offers simultaneous basic theoretical and practical aviation training. In their first year at school, students are required to perform 5 parachute jumps; the second year involves a glider training aimed at obtaining a class III glider pilot license, while a 20-hour plane training is provided in the third school year. Besides practical trainings, theoretical classes are held as part of the Aviation Knowledge Overview course, providing students with the basic knowledge of aviation theory.

Obviously, appropriate health of candidates is required for their admission to the OLL. The occupation of a pilot, particularly of a military pilot, is often associated with extreme burdens to the organism and requires the candidates to have appropriate psychological and physical predispositions. Health-related requirements for aviation personnel are associated with the nature of activities performed during air flights. The working environment in military aviation (gravity loads, insufficient oxygen, vibrations etc.) may put extreme burden on pilots, up to the limits of their physiological capacity. Ability to retain the capability to perform steering functions, and operate complex aviation equipment in these conditions while simultaneously ensuring flight safety requires appropriate selection of candidates for aviation training on the basis of their health status.

The Medical Assessment and Occupational Medicine Centre of the Military Institute of Aviation Medicine is professionally qualified to define guidelines that would allow to screen out unpromising candidates for aviation training. Physicians at the Centre are not only well educated in clinical medicine, but also in aviation medicine and aviation medical certifications.

Considering the above, the Headmaster of the Secondary School of Aviation asked the Military Institute of Aviation Medicine to propose a scope of examinations for the candidates to study at the OLL and to select a group of potential students best predisposed to become pilots.

By the order no. 15 dated 22 January 2013, the Head of the Military Institute of Aviation Medicine established a Medical Recruitment Team to devel-

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Tab. 1. Scope of laboratory and imaging investigations and specialist medical consultations for candidates to OLL Dęblin.

Laboratory investigations	1. Complete blood count with lymphocyte differentiation 2. Erythrocyte sedimentation rate 3. Urinalysis 4. Serum cholesterol, creatinine, bilirubin and glucose 5. ALT, AST 6. anti-HCV, HbS-Ag, anti-HIV ABs, VDRL test 7. Blood type and Rh factor (optional) 8. urine tests for the presence of the following psychoactive substances: – marijuana – cocaine – amphetamine – ecstasy – morphine – methadone – benzodiazepine
Functional and imaging examinations	1. Chest X-ray 2. Electrocardiography (ECG) 3. Echocardiography (cardiac ECHO) 4. Abdominal ultrasound (US) 5. Contrastometry 6. Eye refraction 7. Biocular vision 8. Coriolis test 9. Impedance audiometry 10. Tone threshold audiometry 11. Electroencephalography (EEG) 12. Magnetic resonance scan of the spine and head including the assessment of paranasal sinuses (MRI)
Specialist medical examination	1. Internal/cardiological assessment, including: – Abdominal ultrasound – ECG – Cardiac ultrasound (ECHO) 2. Surgical assessment including: – Spinal MRI 3. Ophthalmological examination, including – Contrastometry – Eye refraction – Biocular vision – Colour vision 4. Laryngological assessment including: – Impedance audiometry – Tone threshold audiometry – Coriolis test – MRI of paranasal sinuses 5. Neurological assessment including: – Electroencephalography (EEG) and MRI of the head 6. Dental examination

op an appropriate scope of examinations and specialist consultations to be carried out with the aim of assessing the health of candidates. The scope of examinations has been approved by the Headmaster of OLL in Dęblin. Table 1 lists the scope of medical examinations and consultations. Psychological tests were also performed in candidates in addition to laboratory and medical examinations.

METHODS

Examinations were performed in the presence of parents or legal guardians in a group of 156 adolescents at the age of 16, including 28 females and 128 males. Examinations were carried out in three-day cycles. After completion of tests, the Medical Recruitment Team analyzed the results of laboratory tests and specialist consultations and assessed candidate's suitability to study and undergo preliminary aviation training at OLL Dęblin.

Laboratory tests listed in Table 1 were carried out using typical equipment in line with the procedures in force for aviation personnel at the Military Institute of Aviation Medicine.

Imaging examinations were carrier out using the following equipment:

- Echocardiography – Toshiba Artida;
- Abdominal ultrasound scans – Toshiba Aplio;
- MRI – Philips Achieva 1.5 T with Nova Dual gradients. The scanning procedure (MRI sequence) was uniform in all candidates;
- Chest X-ray – Siemens Multiplex M digital apparatus;
- EEG – a 24-channel Grass apparatus. The scanning procedure was consistent with the procedure in force for aviation personnel at the Military Institute of Aviation Medicine;
- ECG – 12-lead ELI-350 by Mortara Instrument Inc.
- Laboratory investigations were performed using the following equipment:
  - Johnson&Johnson Vitros analyzer;
  - Sysmex XS-1000i analyzer;
  - Comesa Ilab 650 analyzer.

Psychological assessments were conducted using tests with age norms adequate for Polish adolescents. The overall psychological assessment included the following analyses:

- general knowledge and intellectual ability test (APIS-P),
- oculomotor coordination test (B-1 S),
- attention and concentration test (Co6)
- time-pressure attention and concentration test (DT).
- visuospatial memory test (CORSI),
- personality questionnaires (NEO-FFI, IVE, JSR),

According to the assumed guidelines, the candidates for the Secondary Aviation School should meet the following psychological assessment criteria:

- intellectual capacity: intelligence, visual attention above average;
- psychomotor capacity: perceptiveness and oculomotor coordination above average, no elongation of reaction time;
- personality: lack of emotional immaturity (within age norm) and social non-adjustment; balanced temperament structure, resistance to stress.

Specialist medical examinations were conducted by experienced specialists with specializations not only in clinical medicine, but in aviation medicine as well. Examinations were based on procedures in force for military and civil aviation personnel at the Military Institute of Aviation Medicine.

RESULTS

The young age of candidates and the associated possibility of physiological immaturity of organisms were taken into consideration when analysing the results of examinations and specialist consultations. This was particularly important in the assessment of EEG examinations which often revealed features of bioelectric immaturity of brain and ECG examinations showing features of minor incompetence of bi- or tricuspid valves. Candidates with these abnormalities were considered eligible for studying at the OLL Dęblin.

As mentioned above, the total population consisted of 156 adolescents, including 28 females and 128 males. A total of 83 candidates (53.2%) of the population were considered fit, including 19 females (22.9%) and 64 males (77.1%). A total of 73 candidates (46.8%) of the population were considered unfit, including 9 females (12.3%) and 64 males (87.2%).

Numbers of candidates and basic causes of unfitness for medical or psychological reasons are listed in Table 2.

Of note is the high number of individuals unfit to study at OLL and undergo aviation training (46.8% of the overall candidate population). As shown in the table, the main causes of unfitness were unsatisfactory results of psychological tests, leading to exclusion of 32 candidates (43.8%). It should be mentioned that psychological diagnostics is very sensitive to emotional swings of the candidates, proper rest before taking the test as well as to impacts from external environment during the test itself. The shortage of time available to perform tasks as well as increased stress associated with the tests and ambition to perform at one's best had significant impact in the results. Considering the fact that emotional lability in 16-year-olds may negatively affect the results, some tests were being repeated. The obtained results were analyzed in detail, with the aforementioned factors taken into account.

A total of 41 candidates (56.2%) were considered unfit for various medical reasons. Of note is the fact that besides psychological test results,

Tab. 2. Numbers of candidates and basic causes of unfitness for medical or psychological reasons.

Unfitness reasons	Number of candidates	Basic causes	%
PSYCHOLOGICAL	32	1. Ineffective functioning under the pressure of time 2. Reduced oculomotor coordination 3. Reduced visuospatial capabilities 4. Reduced attention 5. Reduced intellectual capacity 6. Reduced ability of analytical and logical thinking	43.8
NEUROLOGICAL	15	1. Abnormal EEG record 2. Cavum septum pellucidum 3. Pineal cyst 4. Abnormal MRI image of brain	20.5
CARDIOLOGICAL	10	1. Bi-or tricuspid valve prolapse with regurgitation 2. Valvular incompetence 3. Cardiac chambers enlargement with left ventricular hypertrophy	13.7
ORTHOPEDIC	3	1. Multiple Schmorl nodes within Th and L segments with intrabody herniation 2. Intervertebral disc protrusions within Th and L segments deforming the dural sac	4.1
OPHTHALMOLOGICAL	7	1. Incorrect recognition of colours 2. Myopic astigmatism 3. Esotropia, vertical squint	9.6
INTERNAL	6	1. Idiopathic arthritis 2. Ventricular arrhythmias 3. Cholecystolithiasis 4. Arterial hypertension	8.2

neurological reasons were the second most common causes of candidate exclusion (20.5%). As shown in Table 2, these included abnormal EEG records as well as pineal cysts, abnormal brain image or cavum septum pellucidum in MRI scans.

The obtained results are an evidence of quite poor psychological and physical condition of the tested group of adolescents; this was all the more true as various health disorders were also identified in individuals considered fit for the training. These however, were not considered absolute contraindications for future aviation training. In addition, the Medical Recruitment Team took into account the fact that all alumni of OLL Dęblin applying for further aviation training at the Polish Air Force Academy would be reassessed at that time, with the future assessment including the qualification of subjects to individual aviation groups. Only individuals with impeccable health status and appropriately high psychological predisposition will be qualified for the highly maneuverable aircraft training. The remaining candidates with minor health abnormalities will be trained to operate transport aircraft, helicopters as well as to perform ground service duties.

It is difficult to use the obtained results to draw any far-reaching conclusions and claim that the overall health condition of adolescents in Poland is poor. This would also contradict the WHO data suggesting that physical health scored have improved in recent years in nearly all developed countries. However, population studies in this age group have never been conducted to this detail and in so many aspects. It seems that more reliable conclusions can be drawn after screening new candidates to OLL in years to come. The tests will be performed in the same age group, using the same methods and procedures. Comparison of results obtained in successive years will provide a clearer picture of the psychological and physical health status of adolescent candidates for aviation training.

It should be highlighted that modern examination techniques allow ever-more detailed analysis of candidates' health which should translate into appropriate selection of candidates for studying at OLL and WSOSP and, in the future, to perform work tasks on increasingly sophisticated aircrafts that require pilots with particularly high psychological and physical predispositions.