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SHORT COMMUNICATION

ANALYSIS OF MEDICAL AND PSYCHOLOGICAL SELECTION OF CANDIDATES FOR THE AVIATION HIGH SCHOOL IN DĘBLIN FROM 2013 TO 2015

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Abstract: The authors have analyzed the data collected in the Military Institute of Aviation Medicine throughout 3 years of examinations of candidates for the Aviation Medicine High School in Dęblin. This article tackles the dangers of aviation tasks, the range of medical and psychological examinations and their influence on flight safety. The majority of non-acceptance cases were due to psychological and neurological abnormalities. Further attention is paid to the fact that in addition to being part of candidate selection process, the performed examinations sometimes find abnormalities that require further work-up and potential treatment.

Keywords: military pilots, pilot selection, aeromedical examination

Tables: 3 • **References:** 4 • **Full-text PDF:** http://www.pjamp.com • **Copyright** © 2015 Polish Aviation Medicine Society, ul. Krasińskiego 54/56, 01-755 Warsaw, license WIML • **Indexation:** Index Copernicus, Polish Ministry of Science and Higher Education

INTRODUCTION

The F. Żwirko and S. Wigura Aviation High School in Dęblin (AHS) is the only existing high school specializing in aviation in Poland. Graduation from the AHS enables further recruitment for the Polish Air Force Academy (PAFA) and then future work in the Polish Air Force.

In the Aviation High School, theoretical and practical aviation training is carried out in addition to a regular curriculum. Depending on a grade, students have to acquire basic knowledge on aviation, go through parachuting and gliding training as well as a preliminary aircraft training. The faculty tries to comprehensively prepare pupils for the next step in their careers at PAFA. One of the most important acceptance criteria for the AHS is a normal health status, which is the basis for a safe performance of pilot's tasks. This is even more important in the case of a military pilot who has to deal with extreme physical and mental challenges.

Technological advancement and an increasingly complex weaponry requiring sophisticated skills necessitates a new approach towards selection of candidates for pilots.

In their profession, military pilots are faced with a number of threats during flights. The most important of them are listed below:

1. Rapid acceleration of g-force,
2. Hypoxia,
3. Vibrations,
4. Stress,
5. Noise,
6. Trauma (parachuting, emergency ejections),
7. Unnatural position in the cockpit,
8. Temperature changes,
9. Changes in atmospheric pressure (disbarism, rapid decompression).

Health requirements set for air force personnel are related to the above-mentioned threats as well as to the specific activities performed in the air. They put the pilots' organisms through extreme conditions on the verge of their physical and mental capabilities. Being able to perform operational tasks under such circumstances with the maintenance of high safety standards requires proper selection of candidates for training. Therefore, the evaluation of the human factor for the safety of air force personnel during performance of operational tasks in the air constitutes one of the most important issues in the contemporary aviation medicine.

The Aeromedical and Occupational Health Centre affiliated to the Military Institute of Medicine is the professional institution responsible for the determination of guidelines according to which some candidates are disqualified from training due to their health status. Physicians working in the Center are knowledgeable with respect to clinical medicine as well as aviation medicine and appropriate legal regulations.

In this article, we present the results of our three-year experience with selection of candidates for the AHS in Dęblin who during the selection process underwent a series of biochemical and imaging studies as well as specialist medical examinations.

Tab. 1. presents the range of studies and specialist consultations. In addition to the studies presented in Tab. 1., candidates were assessed by a psychologist.

METHODS

The study included 476 participants at the age of 16, 74 girls and 402 boys. As the participants were under age, they were accompanied either by their parents or legal attorneys. The studies were performed within three days and were aimed at an early detection of any abnormalities that could make candidates unsuitable for pilots. Subsequently, the Medical Recruitment Team analyzed all the laboratory studies, imaging studies and specialist consultations, based on which it was decided whether the candidate was suitable for the AHS and aviation training in Dęblin.

Laboratory studies presented in Tab. 1. were performed in accordance with the standards for air force personnel at the Military Institute of Aviation Medicine.

Imaging studies were performed with the use of the following equipment:

- Echocardiograph – Toshiba Armida,
- Abdominal ultrasound – Toshiba Aplio,
- MRI – Philips Achieva, 1.5 T, Dualnova gradient. The same MRI sequence for all participants
- Chest x-ray – digital apparatus Multiplex M, Siemens,
- Electroencephalograph – 24-channel, Grass. A standard procedure adopted at Military Institute of Aviation Medicine
- ECG – 12-channel, ELI apparatus 350, Mortara Instrument Inc.
- Laboratory studies
  - Vitros analyzer, Johnson&Johnson,
  - XS 1000i analyzer, Sysmex,
  - Ilab 650 analyzer, Comesa

For the psychological assessment, tests with appropriate age norms fort the Polish population were used. They included:

– General knowledge and intelligence test (APIS-P),
– Visual-motor coordination (B-1 S),
– Attention and concentration (Co6),
– Attention and concentration under time pressure (DT),
– Visuospatial memory (CORSI),
– Personality questionnaires (NEO-FFI, IVE, JSR).

According to the accepted criteria, candidates for the AHS should fulfill the following psychological criteria:

– Above-average intelligence and spatial attention
– Above-average perception and visual-spatial coordination, normal reaction times
– Emotional maturity (with respect to age), lack of social inappropriateness, balanced temperamental structure, resistance to stress.

As mentioned above, specialist consultation were performed by experienced physicians with expertise in clinical and aviation medicine in accordance with standard procedures of the Military Institute of Aviation Medicine for military and civil air force personnel [1].

Tab.1. Range of laboratory studies, imaging studies and specialist consultations in candidates for the AHS in Dęblin

Laboratory studies	1. Complete blood count with differential	
	2. ESR	
	3. Urinalysis	
	4. Serum cholesterol, serum creatinine, serum glucose	
	5. Liver enzymes	
	6. Anti-HCV antibodies, HbS-Ag, anti-HIV antibodies, VDRL	
	7. Blood type and Rh factor (if indicated)	
	8. Urine test for the following psychoactive substances:	marihuana
		cocaine
		amphetamine
		ecstasy
		morphine
		methadone
		benzodiazepines
Functional and imaging studies	1. Chest x-ray	
	2. Electrocardiography (ECG)	
	3. Echocardiography (heart ultrasound)	
	4. Abdominal ultrasound	
	5. Contrastometry	
	6. Eye refraction study	
	7. Biocular vision study	
	8. Coriolis' test	
	9. Impedance audiometry	
	10. Threshold tone audiometry	
	11. Electroencephalography (EEG)	
	12. Magnetic resonance imaging of the vertebral column, head and paransal sinus	
Specialist medical examinations	1. Medical/ cardiologic examination including	Abdominal ultrasound
		ECG
		Echocardiography (heart ultrasound)
	2. Surgical examination including	MRI of the vertebral column
	3. Ophthalmological examination including	Contrastometry
		Eye refraction study
		Biocular vision study
		Color vision study
	4. ENT examination including	Impedance audiometry
		Threshold tone audiometry
		Coriolis' study
		MRI of the paranasal sinuses
	5. Neurological examination including	Electroencephalography (EEG) and head MRI
	6. Dental examination	

RESULTS

When analyzing study results and specialist consultation based on which candidates were selected for the AHS, we took into account the young age of candidates and the possibility of immaturity of their organisms. This was especially important for the analysis of the electroencephalographic study with a high rate of bioelectrical immaturity as well as echocardiography that detected characteristics of a discrete mitral and tricuspid regurgitation. Candidates with such scores were not excluded from further selection.

In total, we studied 476 participants – 74 girls and 402 boys, of whom 272 (57.1%) were suitable for the AHS – 45 girls (16.5%) and 227 boys (83.5%). The remaining candidates, i.e. 204 participants (42.9%) were unsuitable – 29 girls (14.2%) and 175 boys (85.8%).

The number of participants and common medical and psychological reasons for non-acceptance in respective years are presented in Tab. 2.

Of note, the number of candidates who were unsuitable for the AHS in Dęblin was high (46.8% of all studied participants).

As presented in Tab. 2., the most common reason for non-acceptance were abnormal psychological test results (61 participants, 29.9%). Research carried out by other authors shows that the most frequent psychiatric disorders in children and adolescents under 18 years of age are behavioral disorders, emotional disorders and stressful situations [3]. It should be underlined that psychological testing can be easily influenced by emotional state changes, period of rest before testing or the environment in which the testing is carried out. Other factors influencing psychological testing are time pressure, task-associated pressure or motivation to succeed. Because emotional liability in participants under 16 years of age is a potential confounding factor, the tests were performed twice. The results were carefully examined with attention given to the above-mentioned factors.

Tab. 2. Number of participants and common medical and psychological reasons for non-acceptance.

Reason for non-acceptance	Number of participants			Common reasons for non-acceptance	%
	2013	2014	2015		
Psychological	32	15	14	• Ineffective coping with time pressure • Low visual-motor coordination • Low visuospatial function • Low attention span • Low intelligence • Low ability to think analytically and logically	29.9
Neurological	15	21	16	• Abnormal EEG • Cavum septi pellucidi • Pineal cyst • Abnormal brain MRI	25.5
Cardiologic	10	24	2	• Valvular prolapse • Valvular insufficiency with regurgitation • Ventricular enlargement with left ventricle hypertrophy	17.6
Orthopedic	3	-	6	• Numerous thoracic and lumbar Schmorl's nodes with intravertebral hernias • Thoracic and lumbar disc herniation modeling the meningeal sac	4.4
Ophthalmological	7	2	8	• Color blindness • Short-sightedness • Strabismus	8.3
Medical	6	2	16	• Idiopathic arthritis • Ventricular arrhythmia • Cholelithiasis • Arterial hypertension • Pneumonia	11.8
Laryngological	-	2	3	• Inflammation of the upper respiratory tract • Hearing impairment • Tympanic membrane perforation	2.5

Medical reasons for non-acceptance were found in 143 participants (70.1%). After psychological reasons, neurological causes were the most frequent reason for non-acceptance (25.5%), which are listed in Tab. 3. The detected medical problems were discussed with candidates' parents and were followed by an appropriate work-up when indicated. This is undoubtedly an additional value of the selection examinations and can lead to an early diagnosis and treatment.

Tab. 3. Neurological causes for non-acceptance to the AHs.

1.	Abnormal EEG	13 participants
2.	Pineal cysts	6 participants
3.	Ventricle system asymmetry	2 participants
4.	White-matter T2 hyperintensisties	6 participants
5.	Arachnoid cysts of various locations	13 participants
6.	Septum pellucidum cavity	3 participants
7.	Vertebral canal widening	4 participants
8.	Pituitary cyst	1 participant
9.	Brain angiomas	2 participants
10.	Other, including epilepsy, claustrophobia	2 participants

The above-mentioned abnormalities were direct causes for non-acceptance. However, neurological abnormalities were also present in candidates who were disqualified due to other reasons. For instance, in a person disqualified because of a heart condition, a neurological deficit was also noted, which is not included in the above-mentioned figures.

Although orthopedic abnormalities, as a primary cause for non-acceptance, were present in only a small proportion of disqualified candidates (4.4%), they were more frequent as secondary or tertiary disorders. Most commonly found were Schmorl's nodes in the thoracic and lumbar parts of the vertebral column, which resulted from a history of the Scheuermann's disease. It is estimated that this abnormality is present in 3-5% of teenagers [2]. Low levels of physical activity, sedentary lifestyle, non-ergonomic furniture, heavy backpacks are also among possible culprits.

Our results demonstrate a poor psychophysical condition of the studied group as even the accepted candidates had various health abnormalities, which were not absolute contraindications for air force training.

Moreover, the Medical Recruitment Team took into account the fact that all people graduating from the AHS in Dęblin wanting to apply for the Polish Air Force Academy will have to go through another, final selection process for the particular air force groups. Only candidates with perfect health and appropriate psychological dispositions will be able to train for high-performance pilots. The remaining candidates, with minor health issues, will be trained for transport planes, helicopters and groundcrew.

Based on our results, it cannot be concluded that the general health condition of the Polish youth is poor, although other authors have reported similar data – only 33.16% of pupils do not have any health issues, whereas the remaining 66.84% have at least some health problems [4]. In contrast, according to the World Health Organization, the general health of the youth in developed countries has been improving. However, these analyzes are based on subjective feelings of the surveyed youth and their parents, a tendency towards a greater body height, newborn death rate and prevalence of infectious diseases. It is disturbing that the number of candidates unsuitable for air force training was similar in all three studied years. It can result from a bad condition of educational medicine as well as a lack of modern diagnostic methods in primary medical care. Perhaps, future research will be able to answer these hypotheses.

It should be underlined that modern diagnostic methods are able to assess the health condition of candidates in an increasingly precise manner, which should result in a better selection of candidates for both the AHS and PAFA. Similarly, it should increase safety of air force operations performed with ever more complex equipment requiring from pilots exceptional psychophysical dispositions.

AUTHORS' DECLARATION:

Study Design: Wojciech Dębiński, Bronisław Turski, Adam Jaskowski; **Data Collection:** Wojciech Dębiński, Bronisław Turski, Adam Jaskowski; **Statistical Analysis**: Wojciech Dębiński, Bronisław Turski, Adam Jaskowski; **Manuscript Preparation:** Wojciech Dębiński, Bronisław Turski, Adam Jaskowski; **Funds Collection:** Wojciech Dębiński, Bronisław Turski, Adam Jaskowski. The Authors declare that there is no conflict of interest.

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