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STIGMATIZATION OF MENTALLY ILL PEOPLE BY PARAMEDICS

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Z.M. Przesmyckiego 29
05-510 Konstancin-Jeziorna, Poland
tel. +48 604 776 311
a.luczynska@wydawnictwo-aluna.pl

www.ems.edu.pl

Managing Editor
Agnieszka Rosa
tel. +48 600 600 938
a.rosa@wydawnictwo-aluna.pl

CONTENTS

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DOI: 10.36740/EmeMS202101101 **ORIGINAL ARTICLE**

STIGMATIZATION OF MENTALLY ILL PEOPLE BY PARAMEDICS – PILOT STUDY

Paulina Pisaniak[1], Joanna Żołądź[1], Aleksander Tarczoń[2], Dorota Ozga[3]

1 EMERGENCY MEDICAL SERVICES SCIENTIFIC CIRCLE, DEPARTMENT OF MEDICAL RESCUE, COLLEGE OF MEDICAL SCIENCES OF THE UNIVERSITY OF RZESZOW, RZESZOW, POLAND

2 EMS STUDENTS ASSOCIATION, DEPARTMENT OF MEDICAL RESCUE, COLLEGE OF MEDICAL SCIENCES OF THE UNIVERSITY OF RZESZOW, RZESZOW, POLAND

3 INSTITUTE OF HEALTH SCIENCES, COLLEGE OF MEDICAL SCIENCES OF THE UNIVERSITY OF RZESZOW, RZESZOW, POLAND

Abstract

Aim: Stigmatization is about making a division – people are grouped into better and worse, people with mental disorders are very often perceived as different, which is why they are largely stigmatized. Mental illnesses are a growing problem among the society of developed countries, therefore, the problem of stigmatization of these people has also become noticeable, which may adversely affect their mental condition and the convalescence process. The aim of the study is to assess the degree of stigmatization of mentally ill people by paramedics.

Material and methods: An original questionnaire was used to collect the data, distributed from February 15, 2020 to April 7, 2020. among paramedics working in various medical rescue units and in units cooperating with the National Medical Rescue system. We collected 91 respondents replied. The research was a pilot study.

Results: Paramedics are a professional group that does not show any particular signs of stigmatization in relation to the mentally ill, but single responses were obtained, which may indicate a given respondent's lack of understanding for the mentally ill.

Conclusions: In order to prevent stigmatization of the mentally ill, it is very important to educate not only paramedics, but also representatives of other medical professions who have contact with people suffering from mental disorders.

Key words

mental disorders, stigmatization, paramedics

INTRODUCTION

The definition of mental illness probably appeared at the turn of the 18th and 19th centuries. The scientific work of A. L. J. Balye had a great influence on the formulation and popularization of the term "illness". Although he described mental disorders in people suffering from syphilis, this work was of great importance in the world of science, and above all medicine. He pointed out that mental disorders in people suffering from syphilis are caused by the interaction of organic changes in the patient's brain. Brain lesions began to be recognized as a mental illness [1]. The generally accepted connotation of the term mental illness includes psychological or behavioral abnormalities that are serious enough to require "psychiatric intervention" [2]. Research on mental health is constantly updated. Data on the mental health of European citizens found a leading place in the report "Healtchat a glance: Europe 2018". The results indicated there are not optimistic. The data from 2016 indicate that every sixth inhabitant of the Old Continent suffered from various types of diseases or mental disorders. Based on this calculation, it was found that 84 million people were affected by this problem. According to the above report, anxiety disorders, affecting 25 million people in the European Union, ranks first in the ranking of the most common mental disorders. The second disorder that affected 21 million people was depression. Another was alcohol addiction, which affected as many as 11 million inhabitants of the studied area. The research also showed that bipolar disorder and schizophrenia turned out to be the most common disorders. In 2016, 14,9% of Polish residents complained about abovementioned disorders. It should be noted that in Poland one can often find a lack of empathy towards people with personality disorders. This situation is related to the belief that mentally ill person is treated as an individual lower category. Often this is how sick people are treated by healthcare professionals. The process of stigmatization consists in dividing society: us (mentally healthy) and they (mentally ill). They – negative stereotypes, which count mentally ill people as different from "other" inhabitants. Then occurs social rejection, discrimination understood as unjustified mistreatment of patients. This tends to reduce all the qualities of the stigmatized person to one dimension without noticing the merits of that person.

During the research and analysis of attitudes towards mentally ill people, which are carried out on an ongoing basis in Poland by Center for Public Opinion Research (CBOS), it was noticed that the image of a mentally ill has changed somewhat, it has become less stereotypical – although diverse. The consequences of stigmatization mentioned in many scientific papers are: hiding the disease from members of the community in which the sick person lives, failure to admin to past illness, as well as the respondents' objection to taking up important positions by people who have had a mental illness.

AIM

Assessment of the occurrence of the phenomenon of stigmatization in professional group of paramedics.

MATERIAL AND METHODS

The study was carried out among paramedics, working in the System of the State Medical Emergency. In the period from February 15 to April 7, 2020. A convenience sampling method was used. 91 people took part in the research. An anonymous questionnaire was used to collect the results. The survey questionnaire consisted of fifteen closed questions, to which one could provide one answer out of five to choose from. The research was a pilot study.

RESULTS

Analysis of own research showed that 57 people, which took part in study, were men, consisting of 63% of all. There are 34 women, constitutes 37% of all respondents. The age majority of the respondents is between 30 and 39 years of age, which constitutes 42% of the respondents. Also in the 20-29 age group, it constitutes a high percentage of people (23%) who work in this profession. The next age range is made up of respondents from 40 to 49 years old. This age group is 18 people, which is 20% of the total number of participants in the study. There are 10 respondents aged 50-59, which constitutes 11% of the respondents. A small percentage are retired people who still work in the profession. The education structure of the respondents shows that 40% of the respondents, i.e. 36 people, have Bachelor Degree. The next level of education that the respondents have is a Master's Degree. There are 21 such respondents, which constitutes 23% of the respondents. 14 people, which constitutes 15%, have a technician education. 11 people, which constitutes 12%, have secondary education. 5 people answered that they are students and 4 people did not answer this question. The question about seniority showed the following results: the most numerous is work experience in the range of 0-9 years (41 people, which constitutes 43%). People who study the field of medical rescuer participated in the study, hence the range of working years starts with "zero work experience". The respondents with 20 to 29 years of work experience constitute a large group (22 respondents, i.e. 23% of all respondents). 17 people, or 18% of the interviewers, have a long work experience, 30-39 years old. The next range of working years is between 10 and 19 (13 people, which is 13%). 3 people, which constitutes 3% of the respondents, have work experience of 40 – 49 years. The conducted research shows that as many as 42 people, i.e. 46% of all respondents, work in the Emergency Medical Services.27 people work in the Hospital Emergency Department, which is 23% of the total respondent population. The same data (27 people, 23%) refer to the workplace in the Air Ambulance Service. A small percentage – among the respondents – indicated the Police, the State Fire Service and the Emergency Medical Dispatcher as their workplace. Retired paramedics are a negligible number of respondents, they constitute 2% of the respondents. 35 people – which constitutes 38% of all respondents – live in the countryside. 23 people, which constitutes 25% of the total, live in the city of up to 50,000 inhabitants. The smallest number of respondents live in cities with 100,000 – 500,000 inhabitants, it is 6 people, which constitute 7% of all respondents. The next question was open-ended and concerned the training of the respondents. In response to them, the respondents indicated that they improve their qualifications by participating in courses, ie ALS (Advanced Life Support), ITLS (International Trauma Life Support), Qualified First Aid, EKG (Electrocardiography) (Table 1).

In the next part of the questionnaire, the respondents were asked to indicate to what extent they agreed with the thesis, they could choose the following answers: "I do not agree at all", "I disagree "," I have no opinion "," I agree "," I fully agree ", "I feel better helping a physically ill person than helping a mentally ill." This was the first statement, to which 42 people, or 46%, replied that they strongly disagreed with this statement. 12 people, or 13% of respondents, answer that they do not agree with the message contained in the above question. 24% of respondents have no opinion on this issue, 6% agree with the thesis and 11% fully agree.

The next wording was: "If a friend told me that he is mentally ill – I would like to continue working with him." 42 out of 91 respondents, which constitutes 46% of the respondents, answered that they fully agree. Another 28 people, or 31% of respond-

ents, circled the answer "I agree". These responses definitely demonstrate the full understanding that anyone can get this type of disease. Few, because only 7 respondents – this is 8% of all respondents – are inclined to answer: "I do not agree at all", and 6 people, i.e. 6%, circled the answer that they did not agree to further work with the person who said that she is mentally ill (Fig. 1).

When analyzing the content of "If I was treated for a mental illness, I would not disclose it to my colleagues", 14% of respondents replied: "I fully agree", which means that they would not admit the existing problem. 16 people, representing 18% of all respondents, agree that they would not disclose information about treatment resulting from a personality disorder to colleagues. While 24 people, i.e. 26% of respondents, have no opinion on that subject. Among respondents who would tell people from their work that they are under the care of a doctor, psychologist or therapist due to mental illness, they are 14, which is 16% (their answer is: "I disagree") and 24 people, i.e. 26% of respondents who "They do not agree at all" with the thesis posed in question no. 3 (Fig. 2).

In the case of phrase "If I had a mental illness and I could not deal with it myself, I would think that I have no self-esteem" we got the following distribution of answers: 38% of respondents do not agree at all, 12% do not agree, 34% have no opinion, 9% agree and 7% fully agree with the thesis.

Assumption sounding "Employers should hire mentally ill people who are treated and have the best qualification." for 21 respondents, i.e. 23% was true and they fully agree. The answer "I agree" was given by 21 respondents – 23% of all respondents. There are 28 respondents in the answers to this question, which is 31% of respondents who have no opinion on the issue of employing mentally ill people. Among people participating in the survey, 11 which means 12% of all respondents – indicate the answer that above-mentioned people should not be employed and 9 respondents who constitute 10% of the respondent indicate a strong objection (Fig. 3).

The seventh statement of the questionnaire: "I would go to a doctor who had been treated for a mental illness in the past", were related to the following opinions: 19 people, or 21% of respondents, would definitely go to such a doctor. The opinion of the above mentioned is confirmed by 27 people, i.e. 30% of the respondents who answered "I agree". As in the responses to the previous questions, a significant number of people completing the questionnaire marked the answer "I have no opinion" – 31 respond-

Table 1. Characteristics of paramedics.

Paramedics (N = 91)	**n (%)**
Age	
20 – 29 years	21 (23)
30 – 39 years	38 (42)
40 – 49 years	18 (20)
50 – 59 years	10 (11)
60 years and older	4 (4)
Highest Paramedic Degree	**n (%)**
Master's Degree	21 (23)
Bachelor Degree	36 (40)
Technican	14 (15)
Secondary Education	11 (12)
Student	5 (5,5)
No answer	4 (4,5)
Experience in role	**n (%)**
0 – 9 years	41 (43)
10 – 19 years	13 (13)
20 – 29 years	22 (23)
30 – 39 years	17 (18)
40 – 49 years	3 (3)
Gender	n (%)
Male	57 (63)
Female	34 (37)
Workplace	**n (%)**
Emergency Medical Services	42 (46)
Emergency Department	21 (23)
Air Ambulance Service	21 (23)
Police, State Fire Brigadea, Emergency Medical Dispatcher	7 (8)
Place of Residence	**n (%)**
Village	35 (38)
City up to 50,000 residents	23 (25)
City from 50,000 to 100,000 residents	20 (22)
City from 100,000 to 500,000 residents	6 (7)
City above 500,000 residents	7 (8)

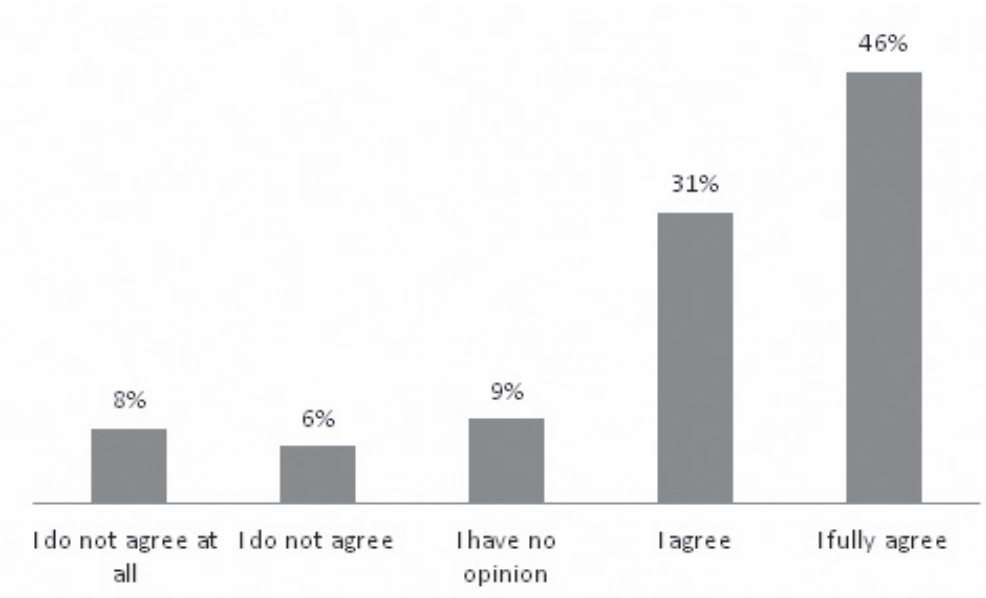

Fig. 1. Distribution of respondents' answers to the statement "If a friend told me that he is mentally ill – I would like to continue cooperation with him".

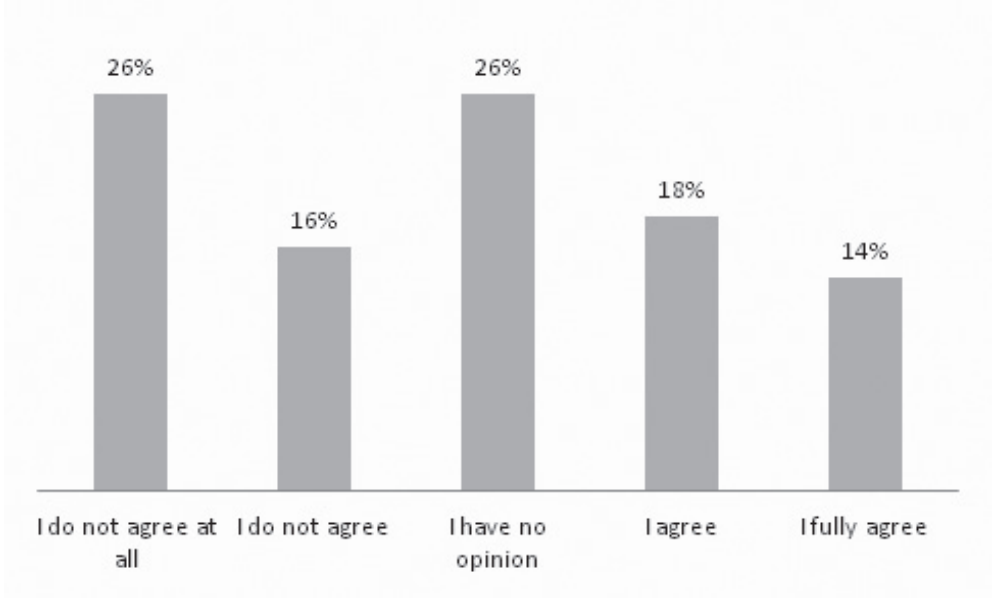

Fig. 2. Distribution of respondents' answers to the statement "If I had been treated for mental illness, I would not disclose it to my colleagues".

ents, which means 34% of the total. Only 8 people, i.e. 9% of the total, state that they would not be treated by such a doctor; and 6 people, i.e. 6%, would definitely not start treatment with a doctor who was mentally ill.

Respondents' responses to the next position, "I would tell my friends that I have a mental illness", were as follows: 34 of the total respondents, which means 37% of the surveyed population, would definitely say that they are mentally ill. 16 people, i.e. 18% of respondents, also agree that they would reveal the news of their illness to their friends. A large number of respondents, i.e. 24 people, who constitute 26% of respondents, have no opinion on the above subject. A small percentage of respondents want to leave this message only to themselves. And so, a definite answer to "No" was declared by 8 people, which are defined by 9% of all respondents; while 9 people answered "No", this is 10% of the respondents.

Then the respondents were shown another piece of information: "Despite the requirements of the profession, I react negatively to mentally ill people." Only

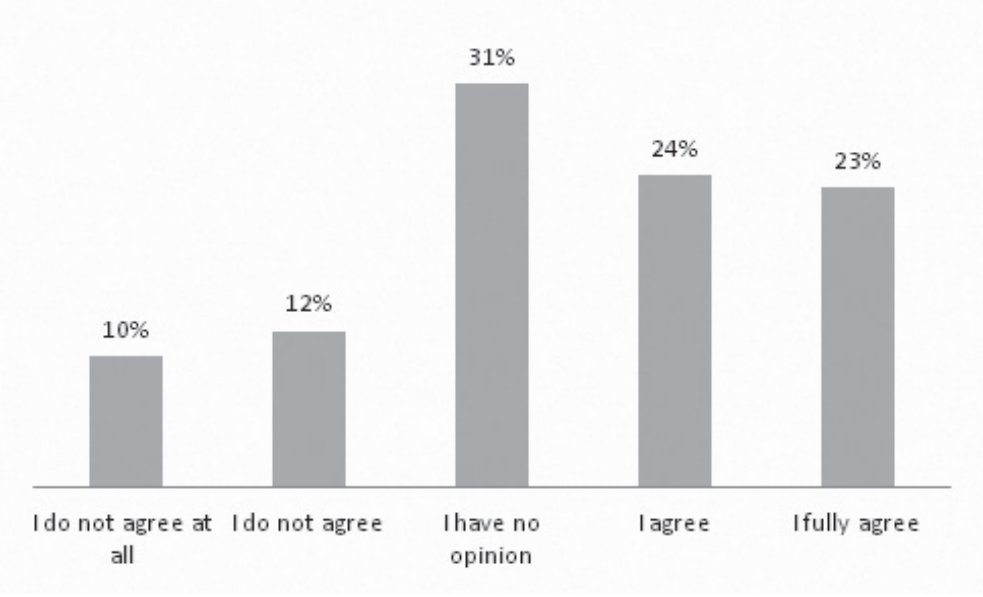

Fig. 3. Distribution of respondents' answers to the statement "Employers should employ mentally ill and treated people, if they have the best qualifications".

2 people, i.e. 2% of the respondents, 100% agree that they react negatively to mentally ill people; and 5 people, i.e. 6%, were in favor of the answer "yes". The answer "I have no opinion" was selected by 16% of the respondents, while "I disagree" and "I do not agree at all" respectively 21% and 55% of the respondents.

Supposition No. 10 was as follows: "I cannot do much to help the mentally ill." For none of the respondents, it was not a statement with which they could "fully agree". 7 people, which means 8% of all diagnosed persons, agrees with the view presented in the analyzed question – they answered "I agree". Another 23 people out of 91 respondents – which constitutes 25% – do not have an opinion on the assumption made in the question. 22% of the respondents did not agree with the thesis, and 45% answered "I do not agree at all".

Another statement was: "More than half of the mentally ill do not need to be treated." 44 respondents, which means 48% of the total surveyed, believe that the answer to this question is "I do not agree at all", and 18% of the respondents answer "I disagree". There are 21 people who do not have an opinion on the presented thesis, they constitute 23% of the respondents. There are 10 people who agree with the content of the question asked, i.e. 11% of respondents ("I fully agree", "I agree").

The distribution of responses to the question: "I would not want a mentally ill person to work with children, even if he was treated" is as follows: 19 people, or 21% of respondents, circled the answer; "I do not agree at all", 9 people, i.e. 10%, replied "I agree". There were a lot of responses "I have no opinion"- 34 – which constitutes 37% of all statements given. 19% of respondents who do not agree with the assumption included in this question, are the paramedics who do not exclude the above-specified group of people from their work. On the other hand, 13% of the respondents gave an indisputable reaction: "I do not agree at all."

In thesis No. 13 the word "spokesman" appears – that is, a person who deals with a certain problem or expresses someone's cases. Paramedics (according to their professional tasks) should provide medical help to the sick, including the mentally ill. However, the role of the spokesman is not their responsibility. A total of 26 respondents, i.e. 28% of the respondents, answered this way, taking into account the sum of the responses "I fully agree", "I agree". "I have no opinion" – such an opinion is shared by a large number of respondents, i.e. 37, and they constitute 41% of all respondents. Similarly, after summing up the answers: "I do not agree" and "I do not agree at all", the result was 28 answers, which were given by the surveyed group of people, which represents 31% of all answers to question 13.

Answers to the next thesis – "I wouldn't mind if my neighbor was mentally ill." are as follows: 17 of all respondents had no doubts about accepting a neighbor with mental disorders. 19 surveyed paramedics, i.e. 21% of the surveyed population, accept a mentally ill neighbor. Many undecided people appear in this question – 25, which constitutes 37% of all respondents. There are 30 people who would not approve of a neighbor burdened with such a disease. They constitute 33% of the respondents.

The last point was: "I have no empathy towards mentally ill people." The answers provided give a sense of satisfaction, as 80 respondents, i.e. 88% of all surveyed, express an opinion in which they do not agree or disagree at all (26% and 62% respectively) with the question. Only 6 people from among the respondents – 7% – have no opinion on the above subject. The answers: "I agree" or "I fully agree" were provided by 5 people, ie 5% of the total number of respondents answering question 15.

DISCUSSION

In the own research, some disturbing relationships were noticed. To the statement: „I feel better helping a physically ill person than mentally" 24% of the respondents answered that they had no opinion – these are the so-called non-content answers. They may arise from an ambiguous feeling about giving an answer. They may also result from the character traits of the respondent or the fear of the consequences of giving an honest answer. It is encouraging that only 15 respondents, i.e. 17% of the total, agree that they are more willing to help people who are physically ill than mentally ill. The conclusion follows from this; the majority of paramedics do not stigmatize the mentally ill in their work. For comparison, according to Williams B. et al., Future paramedics – students of different years of this field of study also do not show negative attitudes towards the mentally ill. This work examined the level of empathy of students in relation to four different types of patients. Patients with mental illnesses, after suicide attempts and intellectually disabled obtained similar results, in contrast to patients abusing psychoactive substances, who did not enjoy such a high level of compassion [3].

Similarly, in the case of a study conducted on a group of Australian paramedics, the results confirmed the stigma of mentally ill people – with depression and psychosis in the situation of their association with the abuse of psychoactive substances – alcohol and drugs. The main reason for this is due to the unpredictable and often aggressive behavior of such people. Additionally, in spite of everything, the respondents showed a probable and certain willingness to keep social distance in the case of people with depression and psychosis [4]. In the study group, in the statement "If a friend told me that he is mentally ill – I would still like to work with him", the respondents replied "I disagree" or "I do not agree at all" – these results indicate that in various professional environments, also among rescuers people with mental disorders, there is still a stereotype of perceiving people with mental disorders, which may be worrying, the researchers of Babicki et al., who checked a similar issue among the general population, came to similar conclusions and it turned out that as many as 17.8% of respondents do not want to have collaborators who suffer mental disorders [5]. Data resulting from the statement "If I was treated for a mental illness, I would not disclose it to my colleagues at work" are very diverse, but as many as 32% of respondents agree with the statement made. These results indicate an existing problem or fear of rejection or discrimination by other colleagues – paramedics or people who are treating themselves, consider it personal knowledge. Research conducted among Poles in the virtual space shows that as many as 19% of respondents say that mental illness is a reason to be ashamed. The largest percentage of respondents who admitted that they consider mental illness a cause for shame were people with higher medical education (20.8%) [5]. The results obtained in the own research are also consistent with the research carried out by the Centre for Public Opinion Research (CBOS) in 2012 [6]. When analyzing the distribution of responses to thesis 4, it was concluded that 46 respondents, which means about 50% of all respondents, believe that in the event of a personality disorder, they would not lose their self-esteem. These data indicate that paramedics are highly aware of mental illness, which also affects their approach to the patient. A large number of people are not determined to give an unambiguous answer, i.e. either they do not know about mental illness or their mental health and feelings related to it do not allow them to express a definite answer. There are 31 such people, which constitutes 34% of all respondents. The results obtained from the analysis of thesis 6 are very optimistic, they show that among a large group of respondents there is no stigmatization of people with mental disorders who want to work in the profession. It is an expression of acceptance of sick and educated people who start treatment. The answers to question 7 are important in the context of understanding for people with a very responsible profession such as a doctor. They show the awareness of the respondents in the area of topics related to mental illness. Only about 22% of the respondents would not go to a doctor who had received psychiatric treatment in the past, similar results were obtained in the CBOS study from 2005, which showed a clear distance from people experiencing mental health problems, consisting in objecting to their roles social, especially if they were associated with responsibility for others [7]. Opinions obtained after formulating thesis 8 suggest that these people would like to talk to someone about their problem if they develop mental disorders. More

than half of the respondents replied that they would share such information with their friends.

Stigmatization is a problem that manifests itself on many levels and has been functioning since antiquity. It should be opposed. Its complete eradication will be very difficult, and in some environments even impossible due to the prevailing stereotypes. However, there are professions such as paramedic, doctor or nurse, in which it should not appear and you have to actively fight it.

On the one hand, the results of the survey inspire enthusiasm, but on the other, we can see how much work needs to be done to completely eliminate the problem of stigmatization, which is why education of the entire Polish society in the field of perception and communication of people with personality disorders is so much needed. It is worth emphasizing that people belonging to the younger generation are more open to fighting social problems that lead to addiction and fighting stereotypes about the mentally ill. Education should focus on the recognition and care of people with specific mental disorders rather than on mental disorders in general mental health are inter-related issues that substantially contribute to the global burden of disease [4, 8].

CONCLUSIONS

The problem of stigmatization is a topic that should be explored more widely, and the interdisciplinary team should undergo a number of courses and training in this area, starting from the undergraduate level to postgraduate training. Own research shows the lack of stigmatization of mentally ill people by paramedics.

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ORCID AND CONTRIBUTIONSHIP *

Paulina Pisaniak – 0000-0002-3777-4590 A, B, C, D, E
Joanna Żołądź – 0000-0001-5377-6150 A, B
Aleksander Tarczoń – 0000-0001-7076-2420 C
Dorota Ozga – 0000-0002-9457-9388 A, B, C, D, E

CONFLICT OF INTEREST

Authors declare no conflict of interest.

ADDRESS FOR CORRESPONDENCE

Dorota Ozga
Instytut Nauk o Zdrowiu
Kolegium Nauk Medycznych
Uniwersytet Rzeszowski
Aleja Rejtana 16c, 35-959, Rzeszów, Poland
tel: +48 575781979
e-mail: gdozga@poczta.fm

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* Contribution: A – Work concept and design, B – Data collection and analysis, C – Responsibility for statistical analysis, D – Writing the article, E – Critical review, F – Final approval.

V INTERNATIONAL CONFERENCE ON MENTAL HEALTH CARE

"MENTAL HEALTH: GLOBAL CHALLENGES OF XXI CENTURY"

ARGIGIENTO, SICILY, ITALY

OCTOBER 21-23, 2021

Mental Health Care (MHC) in the contemporary world has become a global problem with a number of negative consequences. According to the World Health Organization (WHO), mental and behavioural disorders are extremely common and affect up to 25% of all people in different periods of their lives. The WHO notes that in the future, given the ageing population and worsening social problems, the number of MHC cases will increase considerably.

Simultaneously, each country in the world faces significant hindrances in both socio-psychological and economic aspects of the MHC system. No country has yet been able to completely solve this problem. This creates an urgent need in joint efforts towards searching for solutions of common problems.

Main objectives:

- to attract researchers' and policy-makers' attention to MHC urgent problems
- to provide a platform for the exchange of ideas and development of (non)-academic MHC researchers, practitioners and policy-makers networks
- to promote high quality research on MH in developing and in-transition countries
- to investigate transdisciplinary and multicultural solutions of MHC specific issues

Topics:

- MHC systems in the context of global social challenges
- Management, organisation and treatment of Mental Health Issues support
- Specific issues of MHC: child neuro-psychiatry; support for disabled and elderly people; MHC in rural areas; addictive behaviour
- Inter- and trans-disciplinary approach to Global Mental Health issues

Fields covered:

Health, Medicine, Social Science, Psychology, Education, Economic, Law, Counseling, Inter- and Multi-disciplinary studies

OFFICIAL INFORMATION

The information about the conference is available on official website of the Conference:
https://www.mhgc21.org

DOI: 10.36740/EmeMS202101107 **ORIGINAL ARTICLE**

A COMPARISON OF MOUTH-TO-MOUTH, MOUTH-TO-POCKET FACE MASK AND BAG VALVE MASK VENTILATION DURING LIFEGUARDS' CPR: A MANIKIN STUDY

Tomasz Gaszyński, Bartosz Borkowski, Karolina Przybyt-Sibelska, Krzysztof Chmiela

DEPARTMENT OF ANAESTHESIOLOGY AND INTENSIVE THERAPY, MEDICAL UNIVERSITY OF LODZ, LODZ, POLAND

Abstract

Aim: To compare the effectiveness of ventilation of each of three methods: mouth-to-mouth ventilation using a foil face mask with a filter pad, mouth-to-mask technique with a pocket face mask and bag valve mask ventilation using a self-inflating bag and a face mask, performed during CPR by qualified non-medical rescuers.

Material and methods: Ventilation effectiveness was assessed on manikin and compared for mouth-to-mouth, mouth-to-mask and bag valve mask ventilation method. 46 qualified non-medical rescuers-lifeguards participated in the study. Tidal Volume of 0,4-0,7L was considered as effective. The length of chest compressions pauses was recorded. The ventilation methods were also evaluated subjectively by participants in the questionnaire.

Results: Effectiveness 90,75% vs. 92,38% vs. 69,5%; average number of effective rescue breaths: 7,26 vs. 7,39 vs. 5,65; average length of chest compressions pause: 7,7s vs. 8,1s vs. 9,9s for MTM, MPFM and BMV respectively. MPFM method was considered as the easiest, the second in terms of the difficulty in use was MTM, and BMV was described as the most difficult to use.

Conclusions: Artificial ventilation using the pocket mask, in the course of resuscitation performed by one qualified non-medical rescuer, e.g. the water lifeguard, is an effective method ensuring adequate tidal volume and is more effective than mouth-to-mouth method and bag valve mask ventilation.

Key words

mouth-to-mouth ventilation, mouth-to-mask ventilation, bag valve mask; pocket-mask, life-guards, BLS

INTRODUCTION

One of the reasons for not attempting resuscitation by witnesses of the incident, not only people without medical education, but also trained in cardiopulmonary resuscitation (CPR), is the fear of infectious diseases transmitted through mouth-to-mouth ventilation. CPR limited to chest compressions is sufficiently effective for the first minutes following cardiac arrest triggered by cardiac problems, whereas in casualties with cardiac arrest of non-cardiac origin (e.g. victims of drowning, children) ventilation is a vital element of resuscitation . Therefore, according to the ERC (European Resuscitation Council), chest compressions combined with ventilation using proper barrier devices e.g. face masks or foil face masks with an antibacterial filter pad, is recommended for CPR.

AIM

The aim of the study was to compare the effectiveness of ventilation of each of three methods: mouth-to-mouth ventilation using a foil face mask with a filter pad, mouth-to-mask technique with a pocket face mask and bag valve mask ventilation using a self-inflating bag and a face mask, performed during CPR by qualified non-medical rescuers.

MATERIAL AND METHODS

After consulting Local Ethics Committee it was decided that the Ethics Committee Approval was not necessary for this study. Written informed consent was not necessary because no patient data has been included in the manuscript. There were 46 trained / qualified non-medical rescuers – WOPR (Volunteer Water Rescue Service) lifeguards, with at least three years of work experience, participating in the manikin study (Ambu Man). The effectiveness of ventilation methods was assessed on the basis of the number of rescue breaths delivered correctly and the length of pauses in chest compressions needed to perform ventilation. During the study such indicators of proper artificial ventilation like lungs ventilation (no gastric insufflation) and artificial ventilation volume, as the feedback indicators, were seen only by the researcher. The tidal volume between 400 and 700 ml was accepted as correct. Time was measured using a stopwatch with an accuracy of 1 second. Each of the subjects had to perform CPR, in accordance with the procedure for one rescuer included in the BLS Guidelines from 2010, for 4 cycles (30 compressions, 2 breaths) using each of three compared methods: mouth-to-mouth, mouth-to Laerdal pocket mask

Fig.1. Laerdal pocket face mask.
Source: company promotional materials.

(Fig.1), a face mask and a self-inflating bag. During mouth-to-mouth ventilation, the rescuer was kneeling by the side of the victim. As regards CPR performed using the face mask or the mask and a self-inflating bag, the position of the rescuer was staying at the head end of the victim. Before the onset of the study, each participant had the opportunity to practice on the manikin with displayed training parameters.

The second stage of the study consisted of a short author's questionnaire (2 closed questions) assessing the effectiveness of each ventilation method: which method is better and which is easier to learn and perform.

The results were analyzed statistically using the Microsoft Excel 2007 package: Two-sample t Test for means with unequal variances. The statistical significance level was $p<0,05$.

RESULTS

The results of the analysis concerning the effectiveness of the ventilation methods based on manikin feedback are presented in Table 1. The average number of rescue breaths delivered properly for each ventilation methods in 4 cycles of CPR are: 7.26 vs 7.39 vs 5.65 for mouth-to-mouth, face mask and self-inflating bag ventilation respectively. Achieving proper ventilation was the most difficult in case of a self-inflating bag and a face mask. A problematic issue was also obtaining an effective face mask seal. Most of the participants did not seal the mask properly and therefore the first rescue breaths in each cycle were done inefficiently. Due to correcting the way of holding the mask before providing the second rescue breath, its effectiveness has significantly increased. Both mouth-to-mouth and mouth-to-pocket face mask ventilation were characterized by similar effectiveness in ventilation performance. Due to tilting the head back and maintaining its position during ventilation, the airway management was not a problem for any of the participant in both above methods. An appropriate positioning of the mask also did not cause difficulties for any of the subjects. The volume of breaths in subsequent study cycles was very similar regarding the mouth-to-mouth method. Bigger differences in the volume of inspiration in subsequent cycles were observed in the case of the pocket mask and the self-inflating bag- the volumes were decreasing over time. As for the self-inflating bag, there were some cycles with no successful ventilation attempt. A poor mask seal and an insufficient amount of air used for ventilation were the reasons for the lack of its effectiveness. The average length of chest compression pauses is presented in Table 2.

Averaged length of chest compressions pauses regarding the mouth-to-mouth ventilation and mouth-to-pocket face mask method did not differ significantly ($p >0.05$). The average time of interruptions in chest compressions, as for the mouth-to-mouth and mouth-to-pocket face mask ventilation, was significantly shorter than in terms of combining the mask and the self-inflating bag ($p<0.05$). In the case of the bag valve mask ventilation, the subjects needed more time to manage the airway properly and seal the mask.

Table 1. The analysis of ventilation effectiveness of three ventilation methods. Each participant delivered 8 rescue breaths in 4 cycles of CPR performed with the use of each ventilation method according to the guidelines (30 compressions; 2 breaths).

The tidal volume of 0,4-0,7L was considered as effective.

	Mouth-to-mouth	Pocket face mask	Bag valve mask ventilation
Percentage of effective rescue breaths	90,75%	92,38%	69,5%

Table 2. The average length of chest compressions pauses required for providing ventilation. Standard deviation (SD).

	Mouth- to-mouth	Pocket face mask	Bag valve mask ventilation
Average length of chest compressions pauses [s]	7.7 (0.6)	8.1 (0.8)	9.9 (1.2)

Table 3. Results of the author's questionnaire- answers to the second question-the degree of difficulty in using each of ventilation method during CPR.

	Mouth-to-mouth – Mouth-to-pocket face mask	Mouth to mouth – bag valve mask	Pocket mask – bag valve mask
Easier	16	0	37
Comparable	26	8	8
More difficult	4	38	1

Question 1 of the questionnaire was associated with providing rescue breaths considering the risk of infection associated with mouth-to–mouth ventilation method. All respondents declared help to a family member, 30/46 people would use this method in regard to a friend, and only 8/46 would deliver rescue breaths in the case of the unknown victim. Question 2 was to assess the degree of difficulty of the methods tested. The results are presented in Table 3. Comparing mouth-to-mouth ventilation to mouth-to-pocket face mask method, the majority of respondents decided that both methods are similar in terms of the degree of difficulty. Most of the respondents described using the self-inflating bag as more difficult than mouth-to-mouth method. None of the respondents considered using the bag-valve mask ventilation as an easier method. The mouth-to-pocket face mask method was rated as relatively easy, but still more difficult than the mouth-to-mouth ventilation.

DISCUSSION

The above results are similar to those obtained by other authors both in the aspect of the effectiveness of rescue breaths and the time needed to deliver them (length of chest compression pause) depending on the method used [1, 2]. The least effective method of ventilation performed by one rescuer was the bag-valve mask ventilation. On average, every fourth rescue breath was performed improperly and thus ineffectively. However, in the case of mouth-to-mask method using the face mask, the participants of our study managed to achieve effectiveness similar to mouth-to-mouth method (92%), which was significantly higher than in the Lofgren's study (79%) [1]. This discrepancy may arise from different rescuer's position during ventilation: in Lofgren's study by the side of the manikin, and in our study as for the mouth-to-mask method and the bag-valve mask ventilation, over the head of the manikin. Therefore, it seems that the position of the rescuer at the top of the victim's head (over the head CPR) has a positive effect on the quality of ventilation. Time required to deliver two correct rescue breaths (length of chest compressions pause), in the study groups, was the shortest with reference to mouth-to-mouth technique and the longest regarding the bag valve mask ventilation [2].

The tidal volumes (TV) obtained during mouth-to-mouth ventilation and mouth-to-pocket face mask method are comparable, however, in the case of the self-inflating bag and the face mask they were significantly lower [2, 3]. In our study we allowed that tidal volumes between 400 and 700 mL are acceptable although 500 mL is considered as more adequate by ERC Guideliness. This is because from our clinical experience 400 mL are is effective in most of patients

but easier to achieve by non-professional rescuers. In addition, the non-medical rescuers participating in our study considered the method combining the self-inflating bag and the face mask as the most difficult for a single rescuer [1].

Taking into account the greater frequency of gastric insufflation in the case of mouth-to-mouth ventilation than regarding mouth-to-mask technique, the ventilation using the face mask is the method of choice in CPR performed by one qualified non-medical rescuer (e.g. a water rescuer) [4, 5]. The use of face-shields is recommened, however, mouth-to-face-shield ventilation increases interruptions in chest compressions, reduces the proportion of effective ventilations and decreases delivered tidal volumes compared with mouth-to-pocket-mask ventilation [6].

An indisputable argument for the bag valve mask ventilation is the opportunity to provide a patient with high oxygen concentration air from an oxygen source (oxygen tank). However, opening the airway with a jaw thrust and sealing the face mask simultaneously, if performed with one hand, can be difficult even for an experienced rescuer. Medical rescuers have greater experience concerning this method, in comparison to non-medical rescuers (e.g. WOPR). The method of choice in ventilation during CPR performed by two rescuers is the bag valve mask ventilation. Then, the use of airway management devices such as laryngeal masks, laryngeal tubes significantly improves the effectiveness of ventilation, in comparison to both mouth-to-mouth ventilation [7] and mouth-to-mask method using the face mask [8-10]. There are some papers on use of supraglottic dvices for ventilation performed by lifeguards suggesting that this method may be better than ventilation using face-masks or self-inflating bags [11]. However, there are some controversies regarding use of SGD in patients after drowning because of possible laryngoscopasm after drowning [12]. In Poland so far lifeguards are not trained in use of SGD. The program of training of lifeguards includes both moth-to-mouth and face mask-self-inflating bag ventilation.

CONCLUSIONS

Artificial ventilation using the pocket mask, in the course of resuscitation performed by one qualified non-medical rescuer, e.g. the water lifeguard, is an effective method ensuring adequate tidal volume and is more effective than mouth-to-mouth method and bag valve mask ventilation.

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ORCID AND CONTRIBUTIONSHIP *
Tomasz Gaszyński – 0000-0001-5250-3978 A, E, F
Bartosz Borkowski – 0000-0003-0694-3811 D, E
Karolina Przybyt-Sibelska – 0000-0001-9203-3720 B, C
Krzysztof Chmiela – 0000-0001-9023-1272 B

CONFLICT OF INTEREST
Authors declare no conflict of interest.

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ADDRESS FOR CORRESPONDENCE
Tomasz Gaszyński
Katedra Anestezjologii i Intensywnej Terapii
Uniwersytetu Medycznego w Łodzi
ul. Kopcinskiego 22, 90-153, Łódź, Poland;
tel: +48 42 6783748
e-mail: tomasz.gaszynski@umed.lodz.pl

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ASSESSMENT OF INTERVENTIONS COMPLETED BY THE VOIVODESHIP RESCUE SERVICE IN KATOWICE IN THE SILESIAN VOIVODESHIP IN 2018 DUE TO INJURIES

Magdalena Wierzbik-Strońska[1], Klaudiusz Nadolny[1,2], Jerzy Robert Ładny[3], Beniamin Oskar Grabarek[4], Łukasz Pach [1], Dariusz Boroń[4,5]

1 FACULTY OF MEDICINE, UNIVERSITY OF TECHNOLOGY IN KATOWICE, KATOWICE, POLAND
2 DEPARTMENT OF EMERGENCY MEDICAL SERVICE, STRATEGIC PLANNING UNIVERSITY OF DABROWA GORNICZA, DABROWA GORNICZA, POLAND
3 DEPARTMENT OF EMERGENCY MEDCINE, MEDICAL UNIVERSITY OF BIALYSTOK, BIAŁYSTOK, POLAND
4 DEPARTMENT OF HISTOLOGY, CYTOPHYSIOLOGY AND EMBRYOLOGY, FACULTY OF MEDICINE, UNIVERSITY OF TECHNOLOGY IN KATOWICE, ZABRZE, POLAND
5 DEPARTMENT OF GYNECOLOGY AND OBSTETRICS WITH GYNECOLOGIC ONCOLOGY, LUDWIK RYDYGIER MEMORIAL SPECIALIZED HOSPITAL, CRACOW, POLAND

Abstract

Aim: To assess the trips made by Emergency Medical Teams due to injuries (ICD-10 code: S) completed by Voivodeship Medical Rescue Teams in Katowice in 2018.

Material and methods: Analysis of the characteristics of the trips was done based on information contained on "Emergency ambulance travel cards". Statistical analysis was carried out using the t-Student, ANOVA variance as well as the Tukey post-hoc tests ($p<0.05$).

Results: The whole number of trips made by the Emergency Medical Teams in the Silesian Voivodeship totalled 211,896, of which due to the reported injury, the total number of trips was 202,946 cases (183,827 calls were in town – 91%; 19,119 calls were out of town – 9%; $p<0.05$). The most common cause for calls were due to head injuries (S03 – dislocation, sprain and strain of joints and ligaments of the head as well as S04 – cranial nerve injuries). Statistically significant differences in the number of trips depending on cause identification ($p<0.05$) were determined, as well as in comparison to the number of cases identified as S03 and S04 between the in town and out of town territory ($p<0.05$). The median arrival time to an in town site was 7 minutes and 42 second, whereas in out of town sites it was 13 minutes and 19 seconds.

Conclusion: The characteristics of the trips made by Emergency Medical Teams depends on the time, and what is affected by organizational changes in the emergency medical system.

Key words

Silesian Voivodeship, emergency medicine, injuries and poisoning, Medical Emergency Team

INTRODUCTION

The Emergency Medical Services system was created in order to guarantee help to each person, whose health or life was under direct threat. The main act regulating the functioning of the system is the Act from 8th September 2006, in reference to the Emergency Medical Service. Act log: 2020.882 t.j. According to the act, the main goal in functioning of the system on which Medical Emergency Teams as well as Hospital Emergency Wards is reacting in sudden life-threatening situations [1]. In the case of reporting a situation in which there is a desire for a Medical Emergency Team, the medical dispatcher is the first person, who has the ability to gain information about the event, it's place, the number of those injured, their state and also the type of event that took place. Due to this, in everyday practice of the medical dispatcher, it is extremely difficult to draw a fine line between what should be viewed as health or life-threatening and what shouldn't. It is possible that due to a seemingly small bite by an insect, there could be a real danger in a person that is allergic. The situation is completely different, when the patient admits themselves to the Hospital Rescue Department, where the personnel hired there can assess the situation in real time due to direct contact with the victim [2, 3]. Although, some of the reports coming from the Supreme Audit Committee seem rather disturbing,

that some of the patients treat the Hospital Rescue Department as an alternative, quicker method to gain medical guidance or diagnostic tests, for which they might have had to wait before [4]. However, it seems that injuries should be classified as sudden incidents that can threaten the health or life of the person. By analyzing medical rescue history, it can be identified that from ancient to modern times, granting help to victims, who were injured, was the dominating goal of granting medical help and bringing relief to the sufferer. This action determined the creation of medical recur systems, which evolved with time [5, 6].

AIM

The aim of this study was to assess the trips made by Medical Emergency Teams due to injuries – International Classification of Diseases (ICD-10 code: S) completed by Voivodeship Medical Emergency Teams in Katowice in 2018 including identification as well as the time that passed between the report and the time at which the Medical Emergency Team arrived.

MATERIAL AND METHODS

First, from all the accepted reports by the Voivodeship Emergency Rescue Ambulance, only the reports, where the medical distributor found it necessary for an intervention on site of the incident were selected. Second, the analysed trips were narrowed down based on identification criteria, according to the ICD-10. The identifications made using code S were included, these include injuries. After that, the data contained on "Emergency ambulance travel order cards" was imported into a calculatory Excel spreadsheet, after that, statistical analysis was carried out based on a licensed version of the STATISTICA 13 program (Stasoft, Cracow Poland). Firstly, the data was verified using the Shapiro-Wilk test to see whether the distribution of the presented data meets the assumption of normal distribution. Due to the lack of reasons to reject a null hypothesis, further analysis was carried out using parametric tests, such as the ANOVA variance test, and then the post-hoc Tukey test as well as the t-Student test, for independent trials when comparing two variables. All the statistical analysis carried out accepted a statistical significance of $p<0.05$.

RESULTS

The total number of trips made by Medical Emergency Teams in the Silesian Voivodeship was 211,896 cases, of which 91% of the trips were completed in town, and 9% in out of town (village) territory. Based on the available data from the completed "Emergency

Table I. The characteristics of the injuries to which a trip by a Medical Rescue Team was completed in 2018.

ICD-10	Name of disease	Number of cases in a city	Number of cases in a village
S00	Superficial trauma to head	14	2
S01	Open head wound	33	5
S02	Fracture of the skull and facial bones	2	1
S03	Dislocation,sprain and strain of joints and ligaments of the head	98622	8095
S04	Cranial nerve injuries	85069	10997
S09	Other and undetermined head injuries	8	0
S10	Superficial trauma to neck	1	2
S11	Open neck wound	1	0
S13	Dislocation, sprain and strain of joints and ligaments at the neck level	1	1
S19	Other and undetermined neck wound	1	1
S20	Superficial trauma to the chest	8	2
S22	Superficial trauma to the chest	2	0
S29	Superficial trauma to the chest	5	1
S30	Superficial injury to the abdomen, lower back and pelvis	1	6
S39	Other and undetermined wounds to the abdomen, lower back and pelvis	3	1
S40	Other and undetermined wounds to the abdomen, lower back and pelvis	3	0
S41	Open shoulder and arm wound	1	0
S42	Open shoulder and arm wound	3	1
S50	Open shoulder and arm wound	5	0
S51	Open shoulder and arm wound	4	0
S52	Open shoulder and arm wound	2	0
S59	Open shoulder and arm wound	4	0
S60	Superficial injury to the wrist and hand	1	0
S61	Open wrist and hand wound	7	0
S69	Open wrist and hand wound	4	1
S70	Superficial injury to the hips and thighs	3	0
S71	Open hip and thigh wound	1	0
S72	Femur fracture	1	0
S79	Other and undetermined hip and thigh wounds	2	0
S80	Superficial injury to the lower leg	6	0
S82	Lower leg fracture including the ankle joint	3	0
S83	Dislocation, sprain and strain of joints and knee ligaments	1	0
S89	Other and undetermined lower leg injury	1	1
S90	Superficial injury of the ankle joint and foot	1	1
S91	Open wound of the ankle joint and foot	2	1
S99	Other and undetermined ankle joint and foot wound	1	0

ambulance travel cards", it can be observed that due to the reported injury the total number of trips was 202,946 cases (183,827 in town calls – 91%; 19,119 calls in out of town areas; $p<0.05$).

In Table 1, the number of calls of the Medical Emergency Teams due to the type of injury (based on ICD-10) was presented, split between in town and out of town (village) areas. Based on the presented data, it can be observed that a higher number of trips were made by the Medical Emergency Teams in town than out of town. The most common cause for calls constituted head injuries (S03 – dislocation,sprain and strain of joints and ligaments of the head as well as S04 – cranial nerve injuries). The carried out statistical analysis indicated statistically significant differences in the number of trips depending on identification (the ANOVA variance analysis; post-hoc Tukey test; $p<0.05$). Furthermore, the data for independent trials or the number of cases with the S03 or S04 identification in both in town and out of town calls was statistically significant when compared using the t-Student test. In both cases, it indicated statistically significant differences ($p<0.05$). Also, comparing with each other, the total number of interventions both in town and out of town cases, the noted results were statistically significant ($p<0.05$).

The time between the call being placed and the arrival of the Medical Emergency Team to the site of the report was also analyzed. The median time of arrival for in town area was 7 minutes and 42 seconds; upper quartile – 11 minutes and 50 seconds; lower quartile – 5 minutes and 36 seconds; average – 8 minutes and 44 seconds; standard deviation – 3 minutes and 35 seconds, whereas in out of town areas, the median arrival time was 13 minutes and 19 seconds; upper quartile – 17 minutes and 12 seconds; lower quartile – 6 minutes and 28 second; average – 10 minutes and 44 seconds; standard deviation – 4 minutes and 7 seconds.

DISCUSSION

Analysis of the causes for calling Medical Emergency Teams is a significant factor allowing us to determine the functioning of the system as well as for finding the causes of eventual discrepancies as well ways to prevent them. Analyses like these that were carried out are also necessary due to the fact that every taxpayer is also a financier, as well as a beneficiary of the Emergency Medical Service system [1, 4]. The data presented by the Central Statistical Office indicate that the majority of the help granted within the functioning range of the Emergency Medical Service, as well as the basic and specialistic health care was granted within the range of traumatic-orthopedic surgery [7]. In this study we decided to determine the percentage of all cases needing an intervention on site which were due to injuries as well as also determining the time it takes from receiving a report to the time of arrival for a Medical Emergency Team to the site.

Szwamel et al. analyzed the structure of the granted medical benefits as part of the Hospital Emergency Department. They observed that patients with injuries constituted 44% (7801 people of all patients), who were admitted to the department in 2014. The second group of people were those, who were identified using the ICD-10 classification system had the code R, including, among others, an abnormal heart rate, cough, abnormal blood pressure and skin changes (14% – 2441 cases). medcAmong the injuries, injuries to the wrist and arm were dominant (23.9% of all cases (S60, S61, S62, S63)), as well as ankle joint and foot injuries (also 23.9% of all cases (S90, S91, S92, S93)), and also superficial injuries (at 11.2% (S00, S10, S20, S30, S40)) [8]. Comparing the results obtained as part of this work with the observations made by Szwamel et al. [8], a different structure of reported injuries can be found, in cases where the help was granted by Medical Emergency Teams, the dominating injury were those to the head and neck, whereas in Hospital Rescue Departments, limb injuries were dominant. An interesting observation made about the most common causes for trips to be made by Medical Emergency Teams were presented by Dobosz et al. [9]. These authors indicated that the most common cause for trips in 2010 were diseases classified under the letter R, according to ICD-10 classification (37.61% in Bydgoszcz; 23.891% in Konin), injuries were only placed second (16.82% in Bydgoszcz; 13.32% in Konin). Whereas, between the aforementioned observations and the obtained by us data, 8 years have passed, this may be due to the changes which took place in the Emergency Medical System, and also possibly due to the increase in societal awareness about how the Emergency REscue System should be utilised, including Medical Emergency Teams. Therefore, it is not out of the question that one of the probable causes for obtaining different results is an improvement of the access that patients have to both basic and specialistic health care as well as the continuous increase in financial expenditures on health care [10]. In the assumption of the median time for arrival by a Medical Emergency Team in cities above 10,000 residents, the median time should be no higher than 8 minutes within the city territory, and out of town, no longer than 15 minutes. It is also indicated that the arrival time to territory within the town

cannot be longer than 15 minutes, and out of town, on longer than 20 minutes [1, 11]. It is also worth noting that changes introduced into the Act were connected with shortening the time to that which should be taken as the allowed maximum. In the Act from 25th July 2001 regarding the Medical Emergency Services, the maximum arrival time within the territory of the town was taken to be 20 minutes, and outside of town to be 30 minutes [12]. Therefore, it can be assumed that the intention of the legislator is the most effective use of the "golden hour", determined to be time measured through the accident victim, which expires irreversibly, and with improper use can result in the death of the victim [13,14].

In the work discussing the functioning of Medical Emergency Teams based on materials from the Regional Ambulance Service in Lublin, it indicated that the average arrival time of the team to the site of the incident was 8.55 ± 5.16 minutes (0-78 minutes; Q1 – 5 minutes; Q3 – 11 minutes) [15]. First, based on our own data, it can be determined that the Voivodeship Emergency Station in Katowice fulfills the criteria in terms of the recommended arrival time to the site of the incident [9]. Second, if the time of arrival for patients to the Otwock county in 2009, it can be clearly observed that the wait time for help being granted was longer – 9.39 ± 6.87 minutes – than in the case of teams in Katowice [16]. In order to guarantee quality in the services implemented by the Emergency Medical System it is significant for the leader of the trip to note down on the "Emergency medical team departure card" the time that was exceeded in relation to the permitted median and the reason for such a delay. One definite key factor that significantly influenced the shortening of the system time was the introduction of quality control in the system in 2014. Its implementation was an important step in streamlining the process of teamwork and administering human resources, and consequently, in reducing the time taken for an intervention [17]. Analysis of the characteristics of the trips made by Medical Emergency Teams constitutes a significant element in shaping the quality of the whole Emergency Medical System [18].

CONCLUSIONS

The shortening of the elapsed time from the intervention call to the time of arrival of the Medical Emergency Team to the place of the event is systematically observed. This is indicated by both the analysis carried as part of this work and retrospective works from other circles as well as changes in the Emergency Medical Services Act, indicating a maximum expected time to react. The most common cause for calling out a Medical Emergency Team in the Silesian Voivodeship in 2018 were injuries, including those to the head. Comparing all the obtained data with each other, presented in this work with the characteristic most common reporting reasons for Patients in the Hospital Emergency Ward, it can be directly correlated to an increased societal awareness about the Emergency Rescue system, which has the main goal of helping those in sudden life-threatening situations.

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ORCID AND CONTRIBUTIONSHIP *

Magdalena Wierzbik-Strońska – 0000-0002-1472-8946 B, C, D, E, F
Klaudiusz Nadolny – 0000-0003-0355-241X A, E, F
Jerzy Robert Ładny – 0000-0003-4167-1962 E, F
Beniamin Oskar Grabarek – 0000-0003-1633-7145 A, C, D, F
Łukasz Pach – D, E
Dariusz Boroń – 0000-0002-2691-5829 E, F

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ADDRESS FOR CORRESPONDENCE

Magdalena Wierzbik-Strońska
Wydział Nauk Medycznych
Wyższa Szkoła Techniczna w Katowicach
ul. Rolna 43, 40-555 Katowice, Poland
e-mail: magdalenawierzbikstronska@gmail.com

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* Contribution: A – Work concept and design, B – Data collection and analysis, C – Responsibility for statistical analysis, D – Writing the article, E – Critical review, F – Final approval.

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ANALYSIS OF ACTIVITIES IN THE FIELD OF HEALTH PROMOTION,PROPHYLAXIS AND PREVENTION OF MENTAL DISORDERS AMONG CHILDREN AND ADOLESCENTS IN POLAND AND WORLDWIDE

Monika Serkowska[1], Katarzyna Pogorzelczyk[2], Marlena Robakowska[3], Marta Gallas[4], Sylwia Jałtuszewska[5], Daniel Ślęzak[6]

1 SSC INTERDISCIPLINARY HEALTHCARE MANAGEMENT, MEDICAL UNIVERSITY OF GDANSK, GDANSK, POLAND
2 CLINIC AND DEPARTMENT OF EMERGENCY MEDICINE, MEDICAL UNIVERSITY OF GDANSK, GDANSK, POLAND
3 DEPARTMENT OF PUBLIC HEALTH AND SOCIAL MEDICINE, MEDICAL UNIVERSITY OF GDANSK, GDANSK, POLAND
4 DEPARTMENT OF NURSING MANAGEMENT, MEDICAL UNIVERSITY OF GDANSK, GDANSK, POLAND
5 DEPARTMENT OF MEDICAL RESCUE, POMERANIAN ACADEMY IN SLUPSK, SLUPSK, POLAND
6 DEPARTMENT OF MEDICAL RESCUE, MEDICAL UNIVERSITY OF GDANSK, GDANSK, POLAND

Abstract

Aim: The study aims to compare Polish methods of health promotion and prevention (prophylaxis) of mental disorders among children and adolescents with solutions have their effect in other countries when assessing the effectiveness (in both groups).

Material and methods: Based on legal acts concerning mental health protection and data on preventive programs conducted both in Poland and in other countries, not only the methods of operation and the differences between them were compared but also recommendations were made regarding making possible changes to the current activities in Poland.

Results: In territorial self-government units, where help is offered mainly to teenagers, introducing the intervention may be too late. Besides, due to the limited number of places offering such aid, incl. municipal programs, the issue emerges – concerning the ensuring of appropriate preventive measures – which results in the deterioration of the situation in this age group category and eventuate in the escalation of the current situation.

Conclusions: To prevent the widespreadness of the disorders mentioned above, it is necessary to modify and extend the scope of preventive measures and activities regarding mental health promotion in Poland.

Key words

mental health, prevention (prophylaxis), mental disorders, children, adolescents

INTRODUCTION

The current situation regarding child and adolescent psychiatry is quite a big challenge for the Polish health care system. Due to the limited number of psychiatrists specialized mainly in this age group (i.e. 456 being in the practice of their profession) [1], many significant issues appeared, especially with the access to services given. The access to psychological therapies is also found out to be difficult, for which the waiting time, depending on the region, may take up to several years. Moreover, the additional factors, blocking access to professional care, are: underfinancing of services in the indicated specialization, insufficient infrastructure understood as a small number of beds for patients in the wards and, the stigmatization of mental disorders [2]. Therefore, to prevent it, it is essential to support the health care system and to take preventive measures.

AIM

The study aims to compare Polish methods of health promotion and prevention of mental disorders among children and adolescents with solutions have their effect in other countries when assessing the effectiveness (in both groups).

MATERIAL AND METHODS

The material consists of legal acts concerning mental health protection and data on preventive programs conducted both in Poland and in other countries.

The methods of operation were compared and the differences between them were indicated. Also,

recommendations were made regarding making possible changes to the current activities in our country.

RESULTS

Firstly, to talk about activities related to the prevention and promotion of mental health, it is necessary to separate these two concepts. According to the classification of mental health activities, the following forms of intervention can be defined as:

- Mental health promotion – activities aimed at strengthening the mental health of a given population or individual.
- Prevention (prophylaxis) of mental disorders – activities aimed at reducing the risks impairing mental health and reducing the number of incidents of the occurence of disorders and possible further consequences.

It is worth emphasizing that the second type of activities may be considerable due to the current situation, in terms of the psychiatry needs, because in many cases it is necessary to implement tertiary prophylaxis. When designing activities dedicated to children and adolescents, the environment and lifestyle of the group in question should be taken into account. Children and young people are at risk mainly in their households, school and the area in between. In the past, this area was most often "used" by backyard colleagues, however, many social issues have moved to the Internet. The legal act regulating all mental health issues is the Act of 19 August 1994 on the protection of mental health (with all its amendments). It lists several preventive methods being a key in the prevention of mental disorders, such as the creation of preventive actions in educational centres, self-help groups and social initiatives, or taking into account and introducing the topic of mental health promotion in almost every area of life [3]. The second document is the National Mental Health Program for the years 2017-2022. The importance of measures in the prevention of mental disorders, especially depressive ones, is pointed out, without providing specific guidelines [4]. Activities that are most often practised, regarding mental health promotion and prevention of disorders, are: educating in the subject mentioned above and counteracting social stigma; responding to crises, strengthening social support and offering methods of solving problems that lead to a deeper crisis. Due to the current situation of providing the aid to the patients (in terms of organization), three environments can be distinguished – school, psychological, pedagogical, and mental health counselling centres, and the initiatives including non-profit activities. Most importantly, children and young people, apart from organizing the lectures and extra-curricular activities, have the easiest access to the educational resources and can be monitored by the tutors. Preventive programs and easy access to a psychologist are also needed. However, due to insufficient human resources and a lack of mental health training, there are problems with detecting and preventing situations that lead to a crisis. Also, due to the lack of classes concerning the topic of mental health, young people are often not prepared for the breakdown. Consequently, the clinics offer medical and psychological help as an effective method of support for individuals. Here, apart from the shortages of specialists, the barrier is the complete shifting of the burden of responsibility onto the medical staff. The last, quite important element is all municipal initiatives. Preventive and mental health promotion programs are created in the form of educational and extracurricular activities, streetworking and other forms of assistance, also in breakdowns. Many people are unaware of the fact that they are actually ill, due to insufficient promotion. Barriers are also the necessity to meet specific criteria, e.g. concerning the place of residence, and the limited number of places in the program. Thus, there are significant performance problems in both preventive measures and mental health promotion.

DISCUSSION

The model of preventive actions regarding mental disorders is the intervention model recommended by WHO. It assumes four levels of support – promotion of psychosocial activities, education on mental health, psychosocial interventions and professional therapy [5].

One of the most famous programs related to the prevention of mental disorders, among children and adolescents, is the MindMatters program. In the beginning, it was a national program. It assumed the following actions:

- Embedding promotional, preventive and early intervention activities for mental health and wellness in Australian high schools
- Improve the development of a school environment where young people feel safe, valued, committed and goal-oriented;
- Help young people develop the social and emotional skills necessary to meet life challenges and for the school community to create a climate of well-being and positivity;
- Develop strategies to enable continued support for students with additional mental health and wellness needs;

- Enable schools to work better with families and the health sector [6].

An educational and intervention program was created that covers secondary school students and their parents. Using the initiative was voluntary – each school could declare participation. After several years of extended activities, the program was evaluated, based on which the following conclusions that were drawn:

- 98% of secondary schools knew about the MindMatters initiative
- 66% of secondary schools have benefited from at least some aspects of the MindMatters initiative, with government schools using MindMatters more than non-government schools
- In 68% of schools using MindMatters, the implementation team was responsible for the program (which suggests a higher level of involvement in the program)
- 77% of schools have used at least some aspects of MindMatters in the past three years
- 65% of schools used MindMatters as their curriculum source
- 64% of schools reported that employees had attended the last MindMatters career development sessions [6].

Based on materials from the program described above, other countries, including European ones, expressed interest in a similar scheme of activities i.e. German and Swiss adaptation. It largely involved educational activities but they were already introduced in the fifth grade. The conducted classes touched upon the subject of hatred, coping with stress and loss, or prevention and early response to suicide incidents. The evaluation study indicated a minimal impact of activities in the school population, but it is indicated that the period between the program implementation and the study was relatively short [7]. It allows, however, to prepare future members of the community to cope with difficult situations and to react to increasing difficulties.

CONCLUSIONS

Promoting mental health and preventing mental disorders in our country requires not only theoretical but also practical support. Due to many years of neglect and shifting responsibility to units operating in small areas, it is necessary to create coordinated initiatives that can be transferred to other localities, until they become effective nationwide. Education, as well as offering various forms of social support and consultation, are important tools. These activities should be planned and implemented as soon as possible. This is to reduce the negative effects of the situation, solve the problems that are the cause of the condition and prevent the development of events that may turn into a chronic problem requiring taking radical action. The help should not only cover the person applying for help but the whole family, possibly including other elements of the environment, e.g. school. The focus on effectiveness is very important here, the goal cannot be too general, and the people organizing and carrying out the activity must be both competent and ready to undertake the task. It should take into account both the medical aspect and social/legal assistance. Thanks to the above activities, it is possible to support mental health protection and to monitor or early detect potential threats related to both the impact of social interactions and the development of comprehensive solutions to counter new problems.

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ORCID AND CONTRIBUTIONSHIP *
Monika Serkowska – 0000-0000-0001-0912 B
Katarzyna Pogorzelczyk – 0000-0001-6200-1242 C
Marlena Robakowska – 0000-0003-4890-2794 D
Marta Gallas – 0000-0003-1420-498X E
Sylwia Jałtuszewska – 0000-0002-9297-1984 F
Daniel Ślęzak – 0000-0002-0052-5654 A

ADDRESS FOR CORRESPONDENCE
Daniel Ślęzak
Zakład Ratownictwa Medycznego
Gdański Uniwersytet Medyczny
ul. Dębinki 7, 80-211 Gdańsk, Poland
tel. +48 58 349 1659
e-mail: ratownictwo@gumed.edu.pl

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THE EFFECTIVENESS OF USING ECG TELETRANSMISSION DURING EMERGENCY MEDICAL TEAM INTERVENTIONS

Tomasz Ilczak[1], Monika Mikulska[1], Małgorzata Anna Rak[1], Michał Ćwiertnia[1], Piotr Białoń[1], Arkadiusz Stasicki[1], Wioletta Waksmańska[2], Rafał Bobiński[3], Marek Kawecki[1]

1 DEPARTMENT OF EMERGENCY MEDICINE, FACULTY OF HEALTH SCIENCES, UNIVERSITY OF BIELSKO-BIAŁA, BIELSKO BIALA, POLAND
2 DEPARTMENT OF PUBLIC HEALTH, FACULTY OF HEALTH SCIENCES, UNIVERSITY OF BIELSKO-BIAŁA, BIELSKO BIALA, POLAND
3 DEPARTMENT OF BIOCHEMISTRY AND MOLECULAR BIOLOGY, FACULTY OF HEALTH SCIENCES, UNIVERSITY OF BIELSKO-BIALA, BIELSKO BIALA, POLAND

Abstract

Aim: To determine the importance of electrocardiogram (ECG) teletransmission on the time required for decisions on diagnosis and treatment and the transport of patients with myocardial infarction.

Material and methods: This study is retrospective in character and concerns the regional activities of the Bielsko Emergency Medical Services and the possibility of sending medical data electronically from a patient's location to the clinic of interventional cardiology (CIC). Group A (n=237) included patients in whom the Medical Response Team (MRT) confirmed ST-Elevation Myocardial Infarction (STEMI) and carried out an ECG with data teletransmission to the CIC. Group B (n=101) included patients in whom the MRT confirmed STEMI and carried out an ECG without teletransmission. For both groups, the MRT recorded the time of arrival at the patient's location and the time when the patient was handed over to the CIC.

Results: A group of 638 patients were identified in whom the chest pain was of cardiac origin. Of these patients, 338 were identified as patients with diagnosed STEMI. A significant dependence was demonstrated of the time t [mins] of teletransmission (p=0.00308). A significant dependence was demonstrated of the effect of distance s [kms] (p=0.00000). A significant dependence was demonstrated of the time t from the place of residence, taking into account the distance s (p=0.00929).

Conclusions: Using ECG teletransmission in pre-hospital procedures shortens the time for diagnosis and transport of patients with STEMI, and thus improves the results of treatment.

Key words

emergency medicine, acute coronary syndrome, teletransmission

INTRODUCTION

Data transmission in the field of medicine is used widely for sending diagnostic data and conducting teleconsultations, as well as video analysis of a patient's condition. Teletransmission involves cooperation between a medical specialist and a person benefitting from the service – that is a patient – without the need for personal contact. In the Polish healthcare system, this type of teletransmission began at the beginning of the 21st century, and is currently a permanent feature of the diagnostic process for acute coronary syndrome (ACS) [1]. Using this method, data is transmitted directly from a patient's location to a specialist clinic, where a printed or electronic electrocardiogram (ECG) graph readout is analysed by a cardiologist. Thanks to teletransmission, ST-Elevation Myocardial Infarction (STEMI) can be diagnosed and pre-hospital treatment can be begun by the Medical Response Team (MRT) during transport of the patient to the cardiology surgery clinic in order to carry out percutaneous coronary intervention (PCI).

AIM

The aim of this article was to determine the importance of ECG teletransmission on the time required for decisions on diagnosis and treatment and the transport of patients with myocardial infarction.

MATERIAL AND METHODS

This study is retrospective in character and concerns the regional activities of the Bielsko Emergency Medical Services and the possibility to send medical data electronically from a patient's location to the clinic of interventional cardiology (CIC) in Bielsko-Biała. The study was conducted based on an ECG teletransmission system. The information used is from Medical Response Team Intervention Report Cards completed by Medical Response Centre (MRC) managers. The following criteria were applied to limit the number of patients participating in the study.

Study inclusion criteria:

- patients with diagnosed myocardial infarction STEMI,
- residents of the MRC administrative area,
- patients aged 20 or above, irrespective of gender,

Study exclusion criteria:

- patients whose chest pain was of different origin than cardiac,
- patients who were not diagnosed with STEMI,
- patients who suffered sudden cardiac arrest during medical intervention,
- patients transported to a different clinic of interventional cardiology (CIC) not in Bielsko-Biała.

The patients in the study group were divided into two sub-groups. Group A (n=237) included patients in whom the MRT confirmed STEMI and carried out an ECG with data teletransmission to the CIC. Group B (n=101) included patients in whom the MRT confirmed STEMI and carried out an ECG without teletransmission. For both groups and for all patients, the MRT recorded the time of arrival at the patient's location and the time when the patient was handed over to the CIC. The next stage of the study recorded the time t [mins] required for decisions on diagnostics, treatment and transport of patients with myocardial infarction, and the time difference between the time of arrival of the MRT at the patient's location and the time the patient was handed over to the CIC. The distance s [kms] from the patient's place of residence to the CIC was calculated based on the geographical coordinates (GPS) of the two points.

To prove the assumed research aim, statistical analysis of the data was conducted :

- to define the effectiveness of using teletransmission in relation to time t [mins],
- to determine the influence of time t [mins] of the patient's place of residence within the Bielsko-Biała city boundaries or the Bielsko district, taking into account the distance s [kms].

Research into the effect of the time of day or night on the time t [mins] did not demonstrate a statistically significant dependence.

Statistical analysis of the data was conducted using the STATISTICA software package, licence no. JPZP602D415110AR-9.

The selection of statistical analysis method was based on qualitative and quantitative variable types and on ordinal and interval scale types, as well as compatibility of distributions with normal distributions and skewness and kurtosis values. For the qualitative variables, that is place of residence, non-parametric tests were used. Their mutual dependencies were verified by chi-square independence tests. Verification of the dependencies of interval scale type variables, i.e. route and time taken, on category factors, i.e. location and time of day, were conducted using variance analysis wherever the assumptions required by this analysis were fulfilled. The required variance homogeneity was checked using the Levene test. The normality of distribution was verified using the Kołmogorow-Smirnow test. For significant principal effects and interactions, the Tukey HSD (honestly significant difference) test was used for post hoc analysis. The effects of disturbing factors were verified using covariance analysis. If the required assumptions were not met, Kruskal-Wallis rank variance analysis was used. In all tests, the result was taken as significant for $p<0.05$.

RESULTS

In the three-year study period, the number of responses to patients with chest pain totalled 1200. After applying inclusion and exclusion criteria, a group of 638 patients were identified in whom the chest pain was of cardiac origin. Of these patients, 338 were identified as patients with diagnosed STEMI. The demographic data of the patients in the study group is presented in Table 1.

To achieve the study aims, results were selected that documented the effect of teletransmission on the time t for diagnostics and for transport of patients with myocardial infarction to the CIC. Evaluation was made of the dependency of time t as regards the use or non-use of teletransmission and the place of residence within the municipality or district.

Covariance analysis was used to take into account the distance s [kms] from the patient's location to the CIC or to a hospital with a cardiology ward, the use or non-use of teletransmission, and the place of residence within the municipality or district (Table 2-4).

A significant dependency was demonstrated between t [mins] and teletransmission ($p=0.00308$). A significant effect was demonstrated of distance s [kms] ($p=0.00000$). A significant dependency was demonstrated between time t and place of residence, taking into account distance s ($p=0.00929$).

DISCUSSION

According to many authors, teletransmission of ECG in cases of suspected ACS assists medical response teams in making the correct diagnosis, and speeds up the decision regarding the start of treatment [1-6]. Triverdi et al. [7], conducted a study in the USA into the emergency medical response system, in which teletransmission of ECG is not obligatory for patients with suspected acute myocardial in-

Table 1. Demographic data of patients with STEMI.

	Gender		Age			Place of residence	
	F	M	20-50 y. old	50-70 y. old	Over 70 y. old	Bielsko-Biała municipality	Bielsko-Biała district
Test group n = 338	106 31.36%	232 68.64%	34 10.06%	195 57.69%	109 32.25%	181 53.55%	157 46.45%

Table 2. Time t and teletransmission.

Teletransmission	t Average	t st.e	t -95.00%	t 95.00%	n
NO	37.772	1.389	35.017	40.527	101.000
YES	34.979	0.787	33.428	36.530	237.000

Table 3. Time t and place of residence decomposition of effective hypotheses.

Place of residence	t Average	t st.e	t -95.00%	t 95.00%	n
municipality	33.945	0.802	32.362	35.528	181.000
district	37.968	1.150	35.697	40.239	157.000

Table 4. One-dimensional significance tests for time t.

	SS	MS	F	p
s	4941.37	4941.37	34.80	0.00000
Teletransmission	1262.68	1262.68	8.89	0.00308
Place of residence	972.23	972.23	6.85	0.00929
error	47429.81	142.01		

farction (AMI). The results obtained confirmed the high effectiveness in diagnosing STEMI by members of emergency medical response teams. Grieko et al. [8], in research on the emergency medical response system in Italy, demonstrated the influence of ECG teletransmission on shortening the time between the first chest pains and the start of treatment. Tekerlsen et al. [9], in their study on the Danish emergency medical system, where ambulance teams use ECG teletransmission, demonstrated a shortening of delays in the start of STEMI treatment due to fast diagnosis and transport of patients directly to cardiology surgery wards. Dudek et al. [10], presented current standard procedures in Poland for cases of ACS, which places particular emphasis on the model of the early intervention strategy based on a network of cardiology surgery clinics that maintain 24-hour hemodynamic shifts. Kleinrok et al. [11], demonstrated that teletransmission of ECG data and teleconsultations reduce system delays. ECG teletransmission is particularly useful in sparsely-populated rural areas with access to only one hospital in the region able to conduct primary percutaneous coronary intervention (PCI). Zimoch et al. [12], emphasised the influence of delays in diagnosis and treatment on rates of illness and morbidity among patients with STEMI. In cases where ECG data teletransmission was conducted, the time from the moment the MRT was called to the moment reperfusion therapy was started was significantly shorter, and the percentage of indirect transport to a hospital with PCI was lower. De Luca et al. [13], proved that every 30 minutes of delay in starting reperfusion therapy is linked to an 8% rise in morbidity. Our research has shown that if teletransmission is used, the time t for diagnosis and transport of the patient to the CIC is significantly shorter than if teletransmission was not conducted. A significant dependency has also been shown between time t and

a patient's place of residence in the Bielsko-Biała municipality or within the Emergency Medical Centre's administrative area. A significant effect has been shown of the distance s [kms] from the patient's location to the CIC. Research into the effect of the time of day or night on time t [mins] showed no statistically significant dependencies.

CONCLUSIONS

To summarise, the research results presented above confirm that use of ECG teletransmission in pre-hospital procedures results in shortening the time for diagnosis and transport of patients with STEMI, and thus improves the results of treatment.

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ORCID AND CONTRIBUTIONSHIP *
Tomasz Ilczak – 0000-0003-2478-9045 [A, D]
Monika Mikulska – 0000-0002-5412-010X [E]
Małgorzata Anna Rak – 0000-0003-0911-5309 [C]
Michał Ćwiertnia – 0000-0001-9576-8095 [B]
Piotr Białoń – 0000-0002-9744-2678 [B]
Arkadiusz Stasicki – 0000-0002-4754-7308 [C]
Wioletta Waksmańska – 0000-0001-7141-5981 [C]
Rafał Bobiński – 0000-0002-3649-5653 [E]
Marek Kawecki – 0000-0001-9925-5297 [F]

ADDRESS FOR CORRESPONDENCE
Małgorzata Anna Rak
Wydział Nauk o Zdrowiu
Katedra Ratownictwa Medycznego
Akademia Techniczno-Humanistyczna w Bielsku-Białej
ul. Willowa 2, 43-309, Bielsko-Biała, Poland
tel.: +48 888 830 851
e-mail: malgorzatarak999@gmail.com

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REVIEW ARTICLE

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PNEUMONIA IN THE COVID-19 ERA – EMERGENCY ROOM PHYSICIAN'S PERSPECTIVE. PART I – ETIOLOGY AND EPIDEMIOLOGY

Dariusz Kawecki[1,2], Anna Majewska[1]

[1] DEPARTMENT OF MEDICAL MICROBIOLOGY, MEDICAL UNIVERSITY OF WARSAW, WARSAW, POLAND

[2] DEPARTMENT OF EMERGENCY MEDICINE, MEDICAL UNIVERSITY OF WARSAW, WARSAW, POLAND

Abstract

Lower respiratory tract infections are one of the most common causes of death. From many years Poland was ranked fourth among the EU countries with the highest number of deaths from pneumonia. No observational studies among Polish patients with pneumonia have been conducted so far that would enable to determine the true scale of the problem, and no risk and etiological factors that are specific to the population of the country have been defined.

Despite continuous advances in medicine, managing pneumonia remains a challenge for the clinician, especially in the Emergency Department. The greatest challenge is the correct diagnosis of pneumonia, qualification for admission to the hospital ward, as well as outpatient treatment and immediate treatment. Problems in patient care may include: non-specific symptoms, especially in elderly patients who are the most common ED patients, a limited number of tests that can be performed on ED in a short period of time, no clear recommendations regarding the management of the patient, a wide spectrum of pathogens involved in the pathogenesis of pneumonia (and new pathogens, e.g. SARS-CoV-2), bacterial resistance to antibiotics and finally emphasis on profitability of therapy.

The paper describes the epidemiological data and possible etiological factors of community acquired pneumonia. In second part, we will focus on the diagnostic possibilities (including SARS-CoV-2 infections) and the issues related to the treatment.

Key words

community acquired pneumonia, Emergency Department, Covid-19, infection, SARS-CoV-2

INTRODUCTION

Pneumonia has been long known to medicine. The clinical presentation of pneumonia consistent with contemporary observations was reported in ancient writings by Hippocrates and Moses Maimonides, a medieval physician, who wrote: 'The basic symptoms which occur in pneumonia and which are never lacking are as follows: acute fever, sticking (pleuritic) pain in the side, short rapid breaths, serrated pulse and cough, mostly (associated) with sputum' [1].

The auscultatory effects accompanying pneumonia were first assessed by Rene Theophile Hyacinthe Laënnec who invented the stethoscope (1816) and spearheaded physical examination of the chest. He described and classified pneumonia and other lower respiratory tract diseases [2]. At the end of 19th century, William Osler noted: 'Pneumonia remains now, as then, the most serious acute disease with which physicians have to deal' [3]. Despite continuous advances in medicine, this statement remains valid to date.

The proper diagnosis of pneumonia, assessment of eligibility for admission to a hospital ward and treatment of a patient present a challenge to a clinician. Several factors contribute to this difficulty, such as:

1. non-specific symptoms, in particular in the elderly patients and those with cardiovascular and respiratory comorbidities, who are the most frequent patients at the emergency department (ED),
2. diagnostic difficulties resulting from the limited number of tests with high predictive value which can be performed at the ED in short time,
3. lack of unambiguous reliable indicators for community-acquired pneumonia (CAP) severity and patient management recommendations (many recommendations are based on low quality of evidence),
4. widening spectrum of pathogens involved in the pathogenesis of pneumonia, which was the case with HIV and SARS-CoV-2 pandemics,
5. changing patterns of bacterial resistance to antibiotics,
6. increasing focus on cost-effectiveness of therapy and outpatient treatment [4, 5].

In accordance with the Ordinance by the Minister of Health of 27 June 2019 on the Emergency Department (Journal of Laws 2019, item 1213), emergency

departments in Poland are units which provide aid to the patient in emergency medical conditions. The provided aid consists of the initial assessment of the patient and necessary treatment to stabilize vital functions. In view of the above, the following are priorities in the care for patient with pneumonia:

1. disease severity assessment based on physical examination and laboratory test results,
2. respiratory support,
3. initiation of appropriate empiric antimicrobial treatment based on the most likely etiology and antimicrobial resistance pattern,
4. decision concerning the need for hospitalization and/or isolation of the patient [6].

The vast majority of pneumonia cases diagnosed in patients at the ED are community-acquired pneumonia (CAP). However, hospital-acquired pneumonia (HAP) should be suspected in the patient presenting at the ED, if the patient has been hospitalized within the last month or if a central line is present [7].

At present, in connection with the SARS-CoV-2 pandemic, the operation of EDs has been subject to local requirements and guidelines of the Ministry of Health. They are aimed at running virology diagnostics and facilitating clinical decisions which can be taken by the medical staff assessing the patient's clinical condition in terms of risk of Covid-19 disease.

AIM

Pneumonia remains a challenge for the clinician, especially in the Emergency Department. The problem has worsened with the ongoing of Covid-19 epidemic. Considering that the aim of this paper is to show the scale of the problem, referring to epidemiological data and the diverse etiology of community-acquired pneumonia, including Sars-CoV-2 infections.

REVIEW AND DISCUSSION

EPIDEMIOLOGY OF COMMUNITY-ACQUIRED PNEUMONIA

The increased number of hospital admissions and deaths from pneumonia and increasing healthcare costs which have been observed over the recent years, even before new coronavirus appeared, are likely to be related to the aging of the European population [4, 8].

No observational studies among Polish patients with pneumonia have been conducted so far that would enable to determine the true scale of the problem, and no risk and etiological factors that are specific to the population of the country have been defined. The only thing we can do is interpolate data from other European countries and the U.S.

Every year, CAP occurs in about 1% of adults (about 31 per 10,000) in the UK, which translates into more than 100,000 hospitalizations per year with an average length of hospital stay of 6 days. The direct care cost is 441 million pounds. Community-acquired pneumonia is the seventh leading cause of death in the U.S., and between 0.5 million and 1 million patients are hospitalized for the therapy every year. Among them, admission to intensive care unit is required in 10% [9]. Hospitalization due to CAP is required in 46 per 10,000 adults per year. The incidence grows rapidly among people > 65 years of age [4].

Observations in Sweden between 2005 and 2015 showed that mortality within 30 days of getting sick was nearly 10% [10]. Data from studies in Germany indicated that the incidence rate of CAP was 9.7 cases per 1,000 person-years, which corresponds to more than 660 thousand cases annually. It was shown that hospital treatment was required in about 46% of patients with CAP and more than a half of individuals over 60 years of age. Hospitalized patients with CAP were characterized by high in-hospital mortality of about 13%. Even after bedridden individuals and those living in nursing homes were excluded from the statistics, 2.4% of patients with CAP admitted to the ward died within 72 hours from admission [11].

The risks of pneumonia and death certainly increase with age and in individuals with comorbidities. The incidence is impacted in diverse ways by: chronic diseases of the cardiovascular and respiratory systems, dementia, psychiatric and neurological disorders, difficulty swallowing (dysphagia), diabetes mellitus, cancer diseases, chronic liver and renal diseases, immunosuppression. Lifestyle-related factors include smoking, alcohol abuse and alcoholism, and malnutrition, among others [4, 6, 10]. Chronic kidney disease and diabetes mellitus have been recently identified as independent risk factors for secondary sepsis in patients advanced in years; in addition, chronic kidney disease and neurological disease have been identified as independent risk factors for 30-day mortality in patients ≥80 years of age with sepsis secondary to CAP [6, 8].

Lower respiratory tract infections are one of the most common causes of death.

Alarming information about the scale of the problem was presented in the Eurostat report. In 2016, out of 4.5 million deaths reported in the European Union countries, 131 000 were caused by pneumonia. Pneumonia was responsible for almost 3% of all deaths in 2016. Ninety percent of deaths occurred in individuals over 60 years of age, with the incidence of 43/100,000. From many years Poland was ranked fourth among the EU countries with the highest number of deaths from pneumonia (45,26/100 000

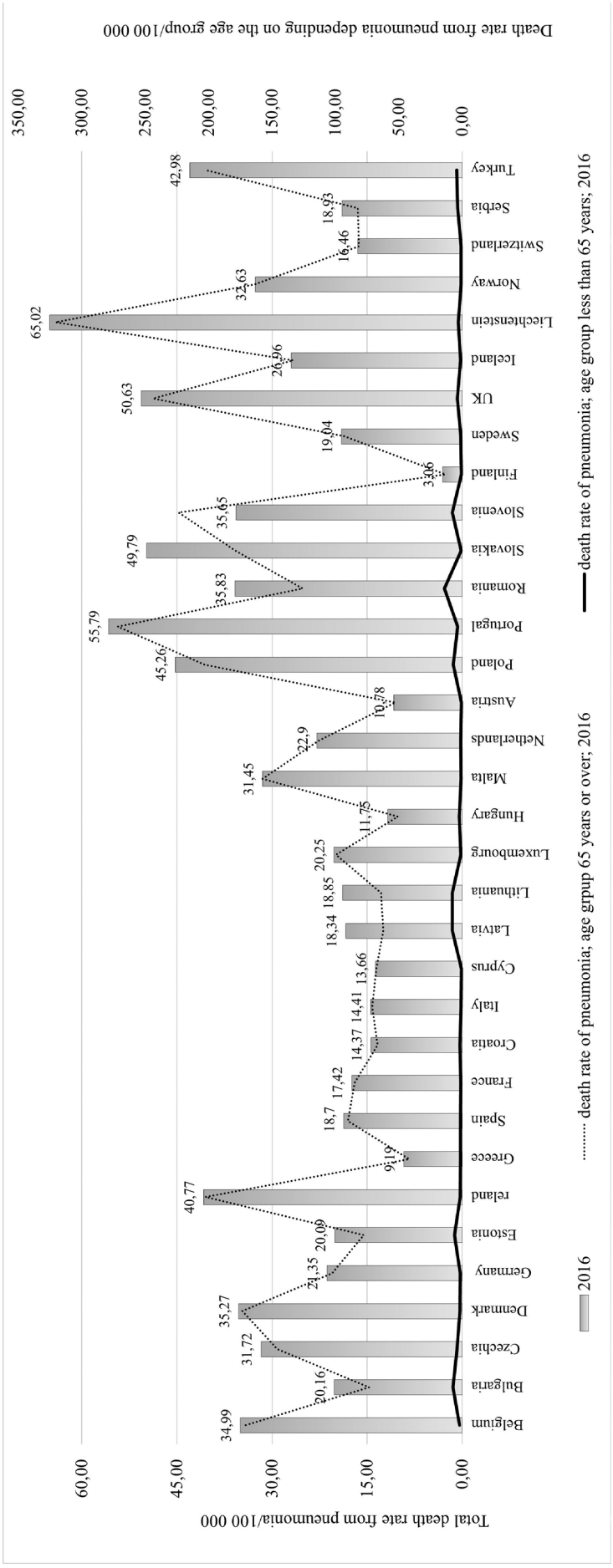

Fig. 1. Total and depending from the age group death rate from pneumonia in residents of European countries in 2016 [12].

inhabitants) (Fig. 1). At European Union countries, the rate stood on average at 26 deaths from pneumonia per 100 000 inhabitants in 2016 [12]. In Europe, the mortality among hospitalized patients is about 5–20%. This range is likely to result from differences in healthcare systems of various countries and data sources, and takes into account varying etiology of infections [4]. The mortality from pneumonia in patients with CAP who are admitted to the intensive care ward is about 20–30% [9]. Those data refer to the period before the emergence of SARS-CoV-2 infections and Covid-19 cases. The emergence of the new coronavirus and its global spread make the epidemiological situation even more complex and force the use of additional procedures in relation to patients with suspected pneumonia at the ED.

ETIOLOGY OF COMMUNITY-ACQUIRED PNEUMONIA

The lower respiratory tract is not sterile, and the presence of microorganisms results from the passage of bacteria (most commonly *Streptococcus* spp. and *Mycoplasma* spp.) from the upper respiratory tract. The disruption of natural defense mechanisms prevents the removal of those and other microorganisms, inflammatory response, and finally clinical manifestation of pneumonia with increased inflammatory markers. Immunocompromised patients are at greater risk for pneumonia, and the range of potential pathogens is broader [4, 6, 13].

Data published to date indicate that bacteria such as *Streptococcus pneumoniae, Haemophilus influenzae* and *Staphylococcus aureus* are the most common cause of CAP. Other etiological factors include *Mycoplasma pneumoniae, Legionella pneumophila and Chlamydophila pneumoniae* [4, 14]. CAP cases caused by Gram-negative bacteria (e.g. *Escherichia coli, Klebsiella pneumoniae, Pseudomonas aeruginosa*) are rare; however, the course of infection involving them may be severe. The presence of those bacteria in the respiratory tract mostly results from microaspiration from the upper respiratory and gastrointestinal tracts, and usually affects the elderly patients or those undergoing psychiatric treatment [6, 15, 16]. The spread of bacteria via the blood from other sites within the body is of less importance in CAP epidemiology. Infections from environmental exposure (water or animals) are not common either; they are endemic, mostly in Asian countries [4]. Nonetheless, several dozens of legionellosis cases (*Legionella* spp.) and over a dozen cases of tularemia (*Francisella tularensis*) are recorded in Poland every year [17].

Viral etiology of pneumonia should be kept in mind during the season of increased frequency of infections with so called respiratory viruses (autumn – early spring) and in children, but also in the case of admission of the immunosuppressed patient after organ or hematopoietic cell transplantation, HIV patient (a wider spectrum of pathogens), and in some special epidemiological situation, such as the one experienced today. So far, many pneumotropic viruses have been described, although viral pneumonia is uncommon and is usually associated with seasonal infections [4, 14, 18, 19]. The most important pathogens are listed in the Table 1. SARS-CoV-2 infections have been a problem in recent months, which forces special approach to the patient with suspected pneumonia. Information published so far indicates that severe pneumonia develops in about 20% of those infected with SARS-CoV-2. Acute respiratory distress syndrome, septic shock and multi-organ failure develop in a portion of those patients. Those symptoms are related to cytokine storm syndrome [20].

Table 1. Etiological agents community acquired pneumonia [14, 17-19].

Bacterial infection	
common pathogens	*Streptococcus pneumoniae* *Haemophilus influenzae* *Staphylococcus aureus* *Mycoplasma pneumoniae* *Chlamydophila pneumoniae*
uncommon pathogens	*Klebsiella pneumoniae* *Pseudomonas aeruginosa* *Legionella pneumophila* *Francisella tularensis*
aspiration pneumonia	*Escherichia coli* *Klebsiella pneumoniae* anaerobic bacteria
Viral infection	
generally not frequent etiologic agents of pneumonia (mainly seasonal infections)	human metapneumovirus (MPV) coronaviruses: SARS-CoV-1, MERS-CoV, SARS-CoV-2 respiratory syncytial virus (RSV) influenza A (IAV), B (IBV) virus parainfluenza viruses (PIVs) human herpesviruses: cytomegalovirus (CMV), varicella-zoster virus (VZV), Epstein-Barr virus (EBV), and herpes simplex virus (HSV) adenoviruses (AdVs) enteroviruses (EVs) hantavirus (HV) parechoviruses (PeVs) measles virus (MV) rhinovirus (RV)
Fungal infection	
uncommon	*Candida* spp. *Aspergillus* spp. *Pneumocustis jiroveci*

Infection with more than one pathogen may occur even in 30% of individuals with pneumonia. In general, co-infections are associated with more serious clinical course [4, 13]. The incidence of secondary bacterial infections is hard to determine due to the lack of detailed indications for tests allowing to detect a co-infection and the lack of comprehensive reporting systems. Bacterial pneumonia is estimated to be a complication in 0.5 – 6% of influenza virus infections, with higher rates among patients hospitalized at intensive care units and those who died from pneumonia. Apart from influenza, parainfluenza virus, adenovirus, human metapneumovirus, measles, respiratory syncytial virus, human rhinovirus and coronavirus are associated with secondary bacterial pneumonia as well. Taking into account the similarity of symptoms and laboratory indicators, differentiation between severe viral infection and viral and bacterial co-infection at the ED is virtually impossible.

Several days are needed to obtain bacterial culture results. Rapid influenza diagnostic tests (RIDTs) detecting influenza virus antigens are not sensitive enough. PCR diagnostic panels show greater sensitivity for most common respiratory pathogens, but they are expensive, are not available in many clinical laboratories and are not able to differentiate bacterial colonization from infection. In the majority of cases, imaging techniques do not allow to identify the etiology of infection, and there are no reliable analytical markers. Indeed, the procalcitonin (PCT) level is associated with negative predictive value for bacterial infection, but this test can be less reliable in patients with shock [13].

There are known relationships between some respiratory pathogens. Influenza virus can facilitate superinfection with *S. pneumoniae* and *S. aureus* [4, 13]. The analysis of information on 1918, 1957 and 1968 influenza pandemics showed that the majority of deaths in influenza-infected individuals were associated with secondary bacterial infection. During AH1N1 influenza pandemic in 2009, secondary bacterial co-infection developed in 4 – 24% of patients with influenza [19]. Mechanisms behind secondary post-viral bacterial infection are complex, multifactorial and depend on interactions between viruses, bacteria and the host immune system. Direct damage to respiratory mucosa, increased microbial colonization and deregulated immune response are important in the pathogenesis of co-infection [21]. Experts from the Infectious Diseases Society of America (IDSA) and the American Thoracic Society (ATS) recommend that antibiotic therapy should be administered in adult patients with CAP who have the positive test result for influenza virus, since bacterial co-infection cannot be excluded [22].

Many papers indicated the possibility of co-infection with coronaviruses (SARS-CoV-1 and MERS Co-V) and other respiratory tract pathogens; bacteria (e.g. *Chlamydophila pneumoniae, Mycoplasma pneumoniae*) and viruses (metapneumovirus, rhinovirus, influenza virus) [22-24]. Current knowledge of the risk, predisposition and effect of co-infection on the clinical course of pneumonia caused by more than one respiratory pathogen in patients with Covid-19 is limited. However, co-infection with respiratory tract microorganisms (bacteria, viruses, or even fungi) cannot be excluded in the patient with pneumonia at the ED. It applies to patients with diagnosed SARS-CoV-2 infection and patients with the detected respiratory tract pathogen other than SARS-CoV-2 [22]. Special attention should also be drawn to immunocompromised patients in whom CAP may be caused by many etiological factors [4].

CAP can also be caused by fungi, including *Aspergillus* spp., *Candida* spp. and *Pneumocystis jiroveci*. Infections with this etiology occur in patients with compromised immune response, most commonly cell-mediated immunity. *Aspergillus* spp. can cause pneumonia in individuals with chronic respiratory tract diseases, those treated with cytostatics, corticosteroids, antibiotics or after exposure to high concentrations of *Aspergillus* spp. spores in the environment. Risk factors for CAP caused by *Candida* include: neutropenia, parenteral nutrition, and intravenous drug abuse. Infections with *P. jiroveci* affect primarily HIV-infected patients (infection indicative of AIDS) and otherwise immunosuppressed individuals [25].

CONCLUSIONS

Epidemiological data for patients with diagnosis of pneumonia, who present at the ED in Poland and globally, are scarce, indeed. The actual share of individual microorganisms in pneumonia etiology in patients at the ED is not known either. The specificity of work and care of patients at the ED, cost policy and lacking possibility to perform microbiological testing and obtain a result in short time prevent from performing comprehensive tests that identify etiological factor(s) for the respiratory tract infection in the majority of cases. Some experts claim that the microbiological test result does not lead to the need for modification of empirical therapy in many cases, and doing tests in each case of pneumonia is

not practical, although microbiological testing has many supporters. Problems related to diagnostics, including microbiological diagnostics of infections, and principles of treatment are particularly important therefore will be discussed in the second part of the paper.

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ORCID AND CONTRIBUTIONSHIP *
Dariusz Kawecki – 0000-0003-0250-4133 A, B, E, F,
Anna Majewska – 0000-0001-9036-7452 A, D, E, F

CONFLICT OF INTEREST
Authors declare no conflict of interest.

ADDRESS FOR CORRESPONDENCE
Anna Majewska
Katedra i Zakład Mikrobiologii Lekarskiej
Warszawskiego Uniwersytetu Medycznego
ul. Chalubinskiego 5, 02-004, Warszawa, Poland
tel: +48 505185287
e-mail: amajewska@wum.edu.pl

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MEDICAL GUIDELINES FOR AIRLINE TRAVEL: MANAGEMENT OF IN-FLIGHT CIRCULATORY ARREST

Paulina Pisaniak[1], Dawid Kurzyna[1], Patryk Stokłosa[1], Patrycja Pisaniak[2], Dorota Ozga[3]

[1] DEPARTMENT OF MEDICAL RESCUE, COLLEGE OF MEDICAL SCIENCES, UNIVERSITY OF RZESZOW, RZESZOW, POLAND
[2] INSTITUTE OF NAVIGATION, MILITARY UNIVERSITY OF AVIATION IN DEBLIN, DEBLIN, POLAND
[3] DEPARTMENT OF DIDACTICS IN INTENSIVE CARE AND MEDICAL RESCUE, FACULTY OF MEDICINE, UNIVERSITY OF RZESZOW, RZESZOW, POLAND

Abstract

In recent times, air transport has become more common, and so the number of passengers using it has increased. As travellers increased, so did the risk of any adverse event related to the health or life of those on board. The staff of the aircraft should be properly trained to be able to help the victim and at the same time be able to stay calm on board the plane. It is also not uncommon for a person with medical education to be present on board the plane – it is important that healthcare professionals know their rights and obligations arising from the situation. The paper presents the procedures applicable to the cabin crew, health care workers present on board and passengers who are at increased risk of a life-threatening episode during the flight.

Key words

Air travel,
cardiopulmonary resuscitation (CPR)
AED,
BLS,
In-flight medical emergencies

INTRODUCTION

Throughout many years, the number of flights has risen significantly and together with the rise in the number of air-travellers increased the risk of the emergence of medical events, such as circulatory arrests, during a flight. Obviously, the development of the aviation industry ought to be followed by the development of medical knowledge, especially the knowledge concerning first-aid procedures. The medical guidelines for airline travel are complex and require knowledge of a variety of medical fields. The knowledge in question should translate to the skills possessed by an airplane cabin crew, who should be able to provide proper medical assistance to the passengers in case of health, or life, endangerment.

AIM

The following paper discusses the issues concerning in-flight circulatory arrest first-aid procedures.

REVIEW AND DISCUSSION

TYPES OF MEDICAL EVENTS

Stress stemming from travelling, change in the rhythm of the day and lower barometric pressure in a cabin are among the main factors which might lead to exacerbation of cardiopulmonary diseases and therefore potentially cause a heart attack. Low humidity, turbulence and stillness all lead to abnormal vasodilation, which puts patents in danger of a vasovagal episode. In addition, stillness is one of the thromboembolic risk factors. Moreover, the aforementioned factors might exacerbate a variety of pre-existing medical conditions. In 2016, approximately 3 billion people world-wide travelled with the use of commercial airline transport. One of the studies has shown that 1 in 14.000 and 1 in 50.000 of the passengers had been in need of medical help during a flight. Cardiac arrest accounts for 0.3% of all in-flight medical emergencies [1]. According to the article entitled Outcomes of Medical Emergencies on Commercial Airline Flights, 11 920 in-flight medical emergencies resulting in the intervention of rescue services had taken place (1 emergencies per 604 flights). Among the most common difficulties occurring during a flight are collapses (37.4% of the cases), respiratory symptoms (12.1%) and nausea or vomiting (9.5%). The passengers or doctors provided first-aid in 48.1% of the emergencies [2].

FORMS OF ASSISTANCE TO A PERSON AGGRIEVED AS A RESULT OF IN-FLIGHT MEDICAL EVENT

"The chances of survival in the case of a sudden circulatory arrest are higher if the event takes place in the presence of witnesses who initiate cardiopulmonary resuscitation prior to the arrival of emergency services" [3]. Help provided by a bystander has an immense impact on the condition of a victim as it leads to a higher likelihood of survival and return to normal functioning. According to ERC guidelines, "Federal Aviation Administration requires every

registered commercial airplane, with the cargo capacity exceeding 3400kg and at least one stwerad, in the U.S. to be equipped with AED, medicine for intravenous administration and advanced resuscitation equipment. In Europe, the corresponding guidelines are less precise" [4]. There should be first aid kits on board each aircraft, including list of contents, sterile swabs, dressings, plasters, hand cleaner or cleaning wipes, eye patch or tape, scissors (if permitted by national law), forceps for removing foreign bodies, disposable gloves, thermometers, mask resuscitation with a one-way valve, the manual "Providing First Aid" and the medical event form – to be completed. The number of such kits should be adequate for the number of passengers and amount to -1, if the number of passengers does not exceed 100, 2 first aid kits should be available in the range 101-200, and in the case of aircraft carrying more than 500 passengers, there should be 6 first aid kits. Protective kits should be carried on board airplanes where cabin crew are required, including dry powder used to transform the exudate exuding from the wound into crystalline granules, fungicide for external use, tampon with disinfectant for skin application, personal protective equipment, i.e. masks, gloves and instructions for use. However, on board an aircraft certified to transport more than 100 people for a distance longer than two hours, there must be an Emergency Medical Kit (EMK) containing medical equipment and medications. The medical kits include drugs such as: noradrenaline, anti-allergic agents, Dextrose 50% (or equivalent), nitroglycerin, basic pain reliever, sedative, anticonvulsant, antiemetic, bronchodilator, atropine, adrenal steroid, diuretic, drug for postpartum bleeding, saline 0.9% (minimum 250 ml), aspirin for oral use, oral antihypertensive drug (beta blocker).The arrangement of the medical kits ought to be uniform in the whole cabin and the location should be safe and easily accessible for the cabin crew [5,6]. Cabin crew completes a 30 hour long first aid training including the use of AED. Those competences ought to be confirmed every 2 years with an appropriate certificate [7]. In one of the studies carried out by the Office of Aviation Medicine, it has been found that out of 2293 cases of special medical equipment use, 85% had taken place in the presence of a medical doctor. The most common situations were fainting, respiratory distress, nausea, and vomiting [8].

In the USA, Canada and England, doctors are not legally obliged to perform first-aid in case of emergencies. However, such countries as Germany and France require such assistance legally in the event of a request from a cabin crew. Nevertheless, practice shows that there is no documented case of a passenger pressing charges against the doctor due to failure to provide medical assistance. Every person responding to a call for help is legally protected by Aviation Medical Assistance Act (1998) according to which "an individual shall not be liable for damages in any action brought in a Federal or State court arising out of the acts or omissions of the individual in providing or attempting to provide assistance in the case of an in-flight medical emergency unless the individual, while rendering such assistance, is guilty of gross negligence or willful misconduct." [9] A doctor should provide help voluntarily, he cannot receive financial remuneration for it. If the doctor orders payment, he may be penalized. Quite frequently, airlines thank doctors for their help with various types of vouchers or free plane tickets. Healthcare professionals providing medical care can use all medical equipment available on board [10].

PROCEDURES FOR AVIATION PERSONNEL

As previously mentioned, the aviation personnel undergoes detailed training in the case of various medical incidents, including heart arrest that may occur during the flight. When someone from the cabin crew recognizes Sudden Cardiac Arrest, then they try to move the victim to a place where chest compressions can begin. Next, airline employees ask passengers if any of them are educated to provide professional medical assistance and if they take full responsibility for the patient. During this time, the aircraft commander inform the air traffic controller about the situation with the message "PAN PAN MEDICAL", which means an emergency situation in which a sudden deterioration of the health of the person on board occurred. The pilot provides the controller with information about the patient select the airport where he will land so that assistance can be provided to the passenger. During this time, cabin crew continuing BLS until:

- they will feel exhaused,
- the patient's spontaneous vital functions will return,
- the doctor on the board confirm patient's death.

The situation is slightly different in the case of cardiac arrest involving one of the pilots while performing operational activities. From now on, the co-pilot takes care of driving the machine and contacting the person providing air traffic control service. Such a state is announced on a frequency with the message "MAYDAY", which informs about the life threatening situation for the crew and passengers.

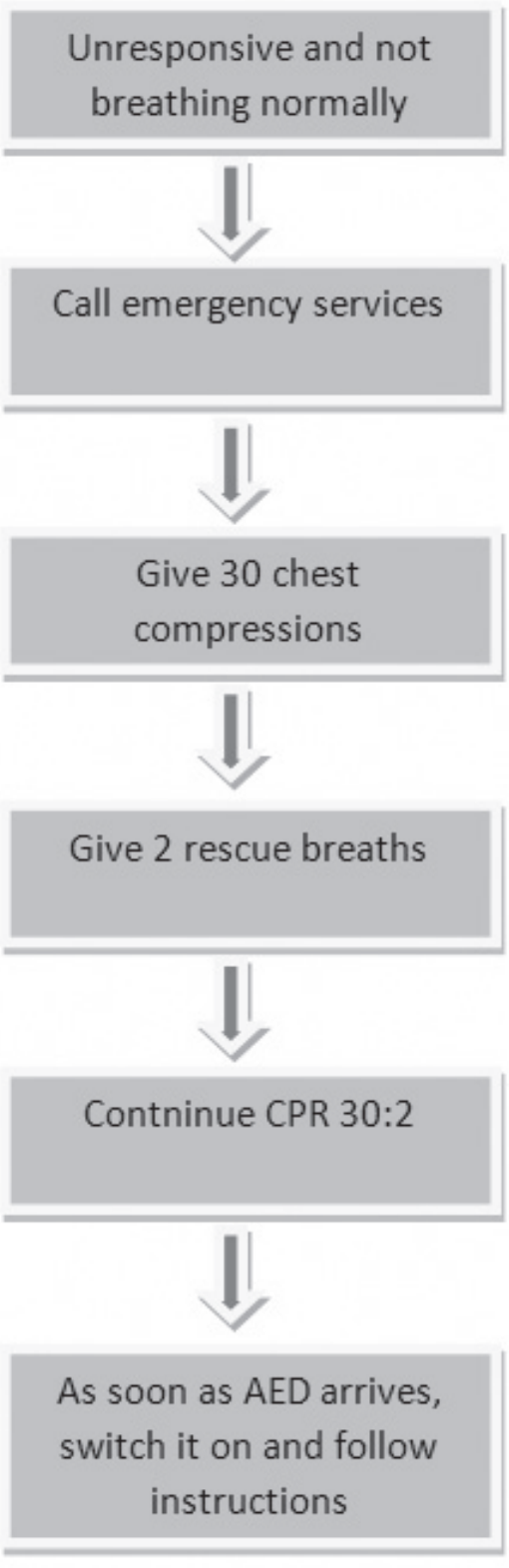

Fig. 1. European Resuscitation Council Guidelines for Resuscitation 2015.

MANAGEMENT OF A SUDDEN CIRCULATORY ARREST

European Resuscitation Council created a simple study-based algorithm of handling cases of a sudden circulatory arrest for people without any experience (Fig.1). BLS-Basic life support includes "decongestion of airways, ventilation and compressing without any additional equipment apart from personal protection measures" [11].

A 2016 study [12] examining the quality of CPR during a helicopter flight showed that the quality of CPR between the two tests, on land and in air, did not differ substantially. The mean depth of chest compression was 52.6mm on land, while in flight it equaled 51.9mm, hence both values were within the normal range. The average speed of compression on the ground was 133, while in air it was 132 per minute. The results for tidal volume were: 752ml vs. 888ml) and the waiting time (9 per cycle in both tests) was higher than the one recommended in 2015. Incomplete thoracic re-expansion was observed in 19% of cases on land and in 26% in-flight cases. The quality of CPR was maintained throughout the 5-minute tests [12]. As can be seen, rescuers are able to perform CPR at the same level of quality both in the air and on land. They only need additional training to avoid excessive pace, tidal volume and non-contact time [12].

Defibrillation plays a crucial role in pre-hospital care and it is one of the most important activities in the fight for life. An automatic external defibrillator can be used by any person, even without medical experience. The device itself instructs the user on what to do and recognizes the heart rhythms which are necessary to start defibrillation. An immensely important aspect of defibrillation is safety. The person performing the defibrillation should announce loudly what they are going to do and direct contact with the victim ought to be avoided during defibrillation. Moreover, one must keep distance from wet surfaces and dry the victim's chest if needed. In one of the studies, the medical records of 10,877 patients were analyzed, in 137 of them AEDs was used, which accounted for 1.3% of all. Among 134 patients accounting for 97.8%, the main symptoms were collapses (41.0%), chest pain (23.9%) and unconsciousness (62.7%). AEDs were used in 24 circulatory arrests. The discharge was carried out in 5 cases. The return to spontaneous circulation occurred in one patient receiving defibrillation and 8 other patients receiving the AED but without shock. All patients, except one, regained their spontaneous circulation, thanks to which they were transported to hospital [13].

When an emergency occurs on an airplane, a quick response is essential. If there is a medical professional on board, proof of professional competence must be presented to the crew. If the medical staff confirms their medical competence, then the passenger requiring medical assistance should be asked if they consent to the examination. The physician should request the crew to make contact with the airline's ground-based medical support for the purpose of consulting, whether it is a minor or a serious medical event. The doctor may ask for an improved emergency kit, but airlines usually have a basic first aid kit available.

If a patient experiences chest pain, severe abdominal pain, is short of breath or when the heart has stopped beating, the doctor may instruct the crew to redirect the plane, but the final decision is to be made by the captain of the plane. It may be requested to lower the ceiling to increase the pressure in the cabin, which will consequently increase oxygenation and reduce gas expansion. Furthermore, paracetamol, ibuprofen or, for very severe pain, morphine may be considered. Antiemetics are available in the kits to help with persistent vomiting. In case of severe chest pain during a flight and uncertainty regarding diagnosis, use an antacid, which can help diagnose indigestion. In case of persistent pain or suspected myocardial infarction, administer oxygen, acetylsalicylic acid, nitroglycerin, and morphine. Request a decrease in flight altitude in order to increase the cabin pressure.

In case of a sudden circulatory arrest, the AED is to be applied immediately. The device analyzes the heart rhythm and helps in making further decisions. If the patient is diagnosed with pVT or VF, the device will start to prepare itself for the discharge, and it is up to the attendant to follow the device's instructions [14].

The fundamental rule is that a passenger should not be considered dead, even if CPR is considered to be futile.

PREVENTION OF THE OCCURRENCE OF ADVERSE MEDICAL EVENTS

In order to prevent emergencies during the flight, people with health problems should follow the recommendations of the aero-medical doctor. Passengers have to take their medications, a list of medications and the dosage information with them. Pharmaceuticals should be in hand luggage in order to provide a quick access to them in the event of an emergency. As far as people with cardiac disease are concerned, it is important for them to possess records of recent tests, in particular ECG, which can help in possible medical emergencies [15].

Some people whose ability to travel is questionable due to possible exacerbation or instability of the disease may also need qualified medical escorts [16].

There are many diseases that increase the risk of an emergency during an airplane flight, including: myocardial infarction occurring 7-10 days before the trip, unstable angina, decompensated heart failure, dysrhythmia, infectious lung infections, PaO2 <67–70 mm Hg without supplemental oxygen, obstructive exacerbation of lung disease, large pleural effusion,

pneumothorax 3 weeks before air travel (7-14 days with medical escort) [16], stroke 5-10 days before air travel, uncontrolled epilepsy or condition 24 hours after a lupus-clonic seizure, surgery 5 days before air travel, pregnancy: from 36 weeks of pregnancy (from 32 weeks of multiple pregnancy) to 7 days after delivery, and the first week of a child's life [16].

Airlines have the right to deny the access to air travel to passengers unfit for air travel for medical reasons.

CONCLUSIONS

The occurrence of in-flight medical incidents is difficult to investigate as air carriers are not required to report in-flight medical incidents and there is no national or international database of occurrences. In the era of modern travel, it is becoming increasingly important to have a clear understanding of the medical consequences of flights. Individuals need to be aware of the possible medical complications associated with air travel, and physicians should identify those potentially at risk and advise them on procedures necessary for safe travel. The incidence of in-flight circulatory arrest is low. The employees on board complete the so-called Recurency First Aid Training, which lasts three days and includes 30 hours of training. Such training should be carried out at least once a year, so that the employees constantly learn and improve their knowledge and competences, and are aware of the responsibility that is placed on them.

Despite the attempts to implement a mechanical resuscitation device that would perform chest compressions and ventilation instead of the crew, research has shown that such a device is less effective in ventilation than humans. CPR in air is challenging and must be sustained over a long period of time.

Airlines should provide the necessary medical equipment to meet the challenges of in-flight medicine. In most cases, the medical incident during the flight is not serious and the cabin crew will be able to deal with the problem effectively. Serious events are rare and are most often caused by heart disease, neurological and respiratory problems. First aid training for cabin crew, the availability of on-board medical kits and remote telemedicine links help in medical emergencies [16].

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ORCID AND CONTRIBUTIONSHIP *
Paulina Pisaniak – 0000-0002-3777-4590 A, B, D
Dawid Kurzyna – 0000-0001-8322-2490 D
Patryk Stokłosa – 0000-0003-1047-3795 D
Patrycja Pisaniak – 0000-0002-5330-0125 D
Dorota Ozga – 0000-0002-9457-9388 E, F

CONFLICT OF INTEREST
Authors declare no conflict of interest.

ADDRESS FOR CORRESPONDENCE
Instytut Nauk o Zdrowiu
Kolegium Nauk Medycznych
Uniwersytet Rzeszowski
Aleja Rejtana 16c, 35-959, Rzeszów, Poland
tel: +48 575781979
e-mail: gdozga@poczta.fm

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DOI: 10.36740/EmeMS202101108 **REVIEW ARTICLE**

FULMINANT SOFT TISSUE INFECTIONS CAUSED BY AEROBIC BACTERIA – A PARAMEDIC'S PERSPECTIVE

Michał Grzegorz Szlagor[1], Rafał Bobiński[2], Monika Mikulska[1], Tomasz Ilczak[1], Michał Ćwiertnia[1], Piotr Białoń[1], Robert Kijanka[1], Arkadiusz Stasicki[1], Katarzyna Styrkosz[1], Marek Kawecki[1]

1 DEPARTMENT OF EMERGENCY MEDICINE, FACULTY OF HEALTH SCIENCES, UNIVERSITY OF BIELSKO-BIALA, BIELSKO-BIALA, POLAND

2 DEPARTMENT OF BIOCHEMISTRY AND MOLECULAR BIOLOGY, UNIVERSITY OF BIELSKO-BIALA, BIELSKO-BIALA, POLAND

Abstract

Infections of the skin and soft tissue are among the most common infections. They are diverse in terms of the extent of the changes, the severity of development and disease group etiological factors. There are a broad range of such infections, from superficial skin infections to deep necrotizing soft tissue infections which are so serious that they can lead to permanent disability or even death. Paramedics are often the first link in the chain of medical treatment for a patient with necrotizing soft tissue infection, which is why it is vital for them to be familiar with the alarm symptoms which indicate that urgent hospitalization is necessary. A key issue for Medical Response Teams when treating patients with skin and soft tissue infections is distinguishing infections that require surgical intervention – a priority for paramedics, from those that require only preventative treatment. It must be remembered that failure to take the correct decisions regarding treatment and logistics can significantly reduce a patient's chances of survival.

Key words

fulminant soft tissue infections, aerobic bacteria, Medical Response Team

INTRODUCTION

SSTI – Skin and Soft Tissue Infections are one of the most common infections. They are diverse in terms of the extent of the changes, the severity of development and disease group etiological factors [1]. They are a common cause of hospitalization, with high incidence and treatment costs, and absence from work as for the vast majority of patients they have a tendency to relapse after the first episode [2]. There are a broad range of such infections, from superficial skin infections to deep Necrotizing Soft Tissue Infections (NSTI) which are so serious that they can lead to permanent disability or even death [3]. The range of necrotizing infections can affect any layer of soft tissue, and is characterized by fulminant degenerative progression and systemic toxicity. The progression of the illness is observed in 70% to 80% of cases in the lower limbs, covering from 5% to 20% of the surface area [2, 4, 5]. Data from the USA shows that the incidence is 0.4% of cases per 100,000 persons, but that NSTI also displays very high morbidity, from 6% to 73% [5-9].

NSTI is described as a poorly diagnosed group of fatal diseases, as initial symptoms are not proportional to the clinical picture [4]. Many authors indicate that early diagnosis of Necrotizing Fasciitis (NF) is missed or delayed in 85% – 100% of cases due to lack of specific clinical features in the initial phase of the infection, while such infections remain a serious medical challenge for paramedics and other medical personnel [7, 9, 10].

AIM

The aim of the study was to analyze the material and review the current literature about fulminant soft tissue infections caused by aerobic bacteria in practice of the Medical Response Teams.

REVIEW AND DISCUSSUION

ETIOLOGY

The skin and its connected tissue are the largest organ in the human body. Its primary function is to serve as a barrier against infections from the external environment. The growth of microorganisms is mainly inhibited by a low pH, the activity of secretory glands, especially the sebaceous glands, as well as the presence of physiological flora on its surface. The number of microorganisms present on the skin varies between several hundred and several thousand per square centimeter. Thanks to this, the growth of pathogenic microorganisms is inhibited by active prevention of colonization by pathological strains, which is why any break in the skin's continuity opens the gate to infection, exposing the layers of soft tissue beneath to the development of infection [11–13].

Skin and soft tissue infections are mainly caused by Gram (+) bacteria, in particular *Staphylococcus aureus* and β-hemolytic streptococci, especially groups A, C, G and B [2, 11, 12]. Of these, *Staphylococcus aureus* is one of the most dangerous infectious pathogens in humans. It is responsible not only for STI, but also significantly affects the severity of early forms of chronic wound infections. Treatment of chronic wounds and the use of numerous antibiotics, especially those mis-prescribed due to lack of microbiological tests, results in infection with more bacterial strains, including aerobic bacteria. The problem of infection by *staphylococcus aureus* is exacerbated by its common prevalence. The general population has 20-30% of permanent carriers, and 30% of people are physiologically colonized. An additional problem is its lack of sensitivity to many antibiotics. The SENTRY program, conducted in Canada and the USA in the years 1998 – 2004, showed that the Staphylococcus aureus strains were responsible for 40% of all skin and soft tissue infections. Another American study conducted in the years 2005–2008 proved that *Staphylococcus aureus* played a role in 66% of chronic SSTI [14].

Currently, there are 32 known types of staphylococcus, of which 16 have been identified as causing infections in humans. The most common include: *Staphylococcus aureus, Staphylococcus epidermidis, Staphylococcus haemolyticus, Staphylococcus saprophyticus* and *Staphylococcus lugdunensis* [12].

The danger to the life and health of the population is not only due to over 100 different pathogens, but also to the development by *Staphylococcus aureus* of antibiotic resistant genes (MRSA – methicillin resistant *Staphylococcus aureus*) [1]. Information on the prevalence of soft tissue infections is imprecise because – as highlighted by American researchers – fewer than 50% of patients with SSTI infections report this fact to their doctor and receive a correct diagnosis [1, 3]. In response to the continual increase of infections caused by CA – MRSA (community associated methicillin resistant *Staphylococcus aureus*), statistical analysis was conducted and showed that between the years 2000 and 2005, the proportion of CAMRSA infections among all MRSA rose considerably from 11% to 33%. The majority of these infections were SSTI, which increased in the same period from 75% to 87% [15].

Adoption of an antibiotic therapy strategy for staphylococcus infections is also dependent on other properties which the microorganisms may display: MRSA – methicillin resistant *Staphylococcus aureus*, VRSA – vancomycin resistant *Staphylococcus aureus*, VISA – *Staphylococcus aureus* with lowered sensitivity to vancomycin, MRCNS – coagulase-negative methicillin-resistant staphylococci, MSSA – methicillin sensitive *Staphylococcus aureus*, PSSA – penicillin sensitive *Staphylococcus aureus,* MRSE – methicillin resistant *Staphylococcus aureus* [12].

Streptococcus pyogenes is one type of group A streptococci (GAS), and is another very common human pathogen that can cause severe invasive illness in 2.79 people out of 100,000. Of these patients, 8% are diagnosed with GAS – NSTI, of whom 50% experience Streptococcus Toxic Shock Syndrome (STSS) [11]. In the USA, there are 3.5 cases of GAS infection per 100,000 people, among whom NF affects 6% of patients.

The significant mortality is related principally to two sub-types pf necrotizing infections: NF type I 21% and NF type II 14 – 34% (described later in the article). Every year in the USA, there are almost 10,000 invasive infections caused solely by *Streptococcus pyogenes*, of which around 7% are necrotizing soft tissue infections [11, 16] (Fig. 1-2).

The majority of soft tissue infections are only superficial and relatively mild and are a common part of the everyday work of a paramedic, either as a principal condition or one accompanying other illnesses (Fig. 3). The diversity of microflora in infections can be a variable, and the sources of infection can originate both in the host and in their surroundings [11–13].

SOFT TISSUE INFECTION SYMPTOMATOLOGY

The nomenclature for skin and soft tissue infections is still not uniform, and the classification of types of infections differs between publications depending on the criteria adopted. For paramedics, a systematized division would be useful for distinguishing between infections and would help in taking decisions on the required treatment. For this purpose, infections are divided into: primary infections (for skin unchanged by earlier illness, and infections caused most commonly by group A pathogens or *Staphylococcus aureus*); and secondary infections (that is a complication to an existing chronic illness, e.g. atopic dermatitis; where a primary infection interferes with the skin's natural defenses and thus creates a gateway for infections by virulent microorganisms). Another classification is based on the illness history and the way the infection spread: uncomplicated infections (usually superficial, with local symptoms and treatment), and complicated infections (in the deeper layers of soft tissue, i.e. fascia, muscles, and requiring surgical intervention; infections of the rectal area or armpits). Complicated

Fig. 1. A fulminant purulent streptococcal infection in the left thigh (own material).

Fig. 2. Streptococcal phlegmon in the course of necrotic infection of the left forearm (own material).

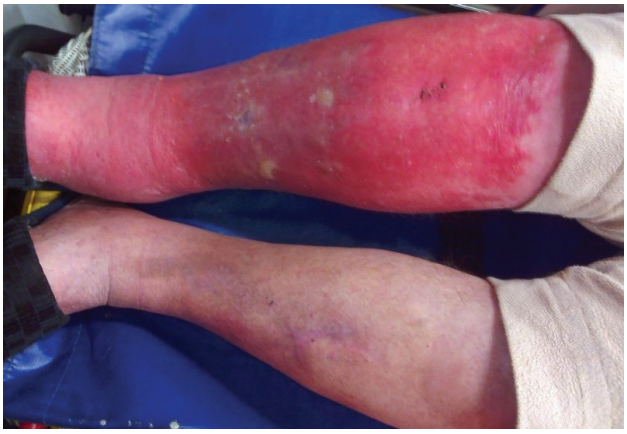

Fig. 3. Necrotizing form of erysipelas in the right calf (own material).

Fig. 4. Mixed soft tissue necrosis. Condition after open fracture of the calf. Surgically treated (own material).

Fig. 5. Mixed anaerobic necrotizing infection. Condition after fracture of the calf. External leg brace (own material).

necrotizing infections are classified as: complicated chronic infections (lasting many weeks or months), and severe complicated infections (development of the illness measured in days or up to several weeks). The location of the disease is a further criterium for dividing infections into: local or focal infections (e.g. impetigo, abscesses), and general infections (e.g. cellulitis, NSTI). The key to the success of treatment for serious infections is above all the following classification: non-necrotizing infections and necrotizing infections (covering torso and limb muscle groups; some authors equate necrotizing soft tissue infections with infection of the fascia) [13].

The development of an infection depends on a variety of factors occurring at the right time, including factors related to the patient themselves as well as to the microorganism present. The risk factors are above all: reduced immunity, accompanying diseases – including diabetes and peripheral circulatory disorders, obesity, advanced age, alcohol and nicotine addiction, being a carrier of pathological strains, multiple use of antibiotics for a variety of reasons, long-term incapacitation, changes in the skin and tissues (burns, bedsores, ulcers, diabetic foot) and the type of wound (bite, contaminated soil, human and/or animal excrement) [4, 8, 14, 17].

TYPES OF NECROTIZING SOFT TISSUE INFECTIONS

The Giuliano classification, which defines types of necrotizing soft tissue infections, is based on the type of pathogen involved in the infection. According to this, we can distinguish Necrotizing Fasciitis (NF) into four types: NF type I (mixed, multiple aerobic and anaerobic bacterial infection; if the infection in is the rectal area or crotch, it is called Fournier gangrene; particularly noticeable is the share of at least one anaerobic microorganism) (Fig. 4-5).

NF type II are infections caused by GAS, either as the only infectious agent, or in combination with *staphylococcus aureus*; the infection mainly affects the lower limbs; the infection is often a trigger for the development of Toxic Streptococcal Like Syndrome (TSLS). NF type III has been added only by certain authors and refers to gas gangrene (clostridial myonecrosis), GAS gangrene infections spread to skeletal muscles, which may be linked to an earlier injury or surgical procedure. Other authors also include in this type infections caused by *Vibrio vulnificus*, where the infection spreads through a wound caused by sea insects. NF type IV is caused by candida fungal infections [9, 13].

The American FDA (Food and Drug Agency) defines soft tissue infection in such a way as to group wounds of similar extent, etiology and severity of infection. A new group of infected wounds was created, Acute Bacterial Skin and Skin Structure Infections (ABSSSI), which means severe bacterial infection of the skin and soft tissues. Another reason for the new division was the need to specify infected wounds for which reliable assessment of the effect of different antibiotic therapy is possible. According to the new definition, an infection can be classified as ABSSSI is the surface area affected by pathological changes covers at least 75 cm^2 – measured as the area affected by redness, swelling or calluses. ABSSI syndrome includes: inflammation of connective tissue/erysipelas (understood as diffuse skin infections with a spreading area of redness, swelling and/or calluses), infections of a wound/surgical scar (visible by purulent leakage from the wound accompanied by redness, swelling and/or calluses on the skin around the wound), and a large skin abscess/phlegmon (the infection is characterized by a pus accumulation within the dermis or beneath, accompanied by symptoms of redness, swelling and/or calluses) [1].

The crucial element is to determine the presence of necrotic components, which distinguish NSTI from milder forms of soft tissue infection. As part of this division, correct identification of microorganisms has a significant impact on the application of

the most suitable antibiotic therapy, as *Streptococcus pyogenes* and *Clostridium perfringens* require different methods of treatment than *Staphylococcus aureus* or *Streptococcus pneumoniae*, both of which are resistant to methicillin. Precise identification of the bacteria plays a key role in identifying the primary gateway for bacteria or outbreaks of infection [8].

THE COURSE AND SYMPTOMS OF SOFT TISSUE INFECTIONS

In NSTI infections, necrotic changes affect the deeper layers of soft tissue and fascia, and then spread along the tissue surface, where the necrosis can also reach the muscles. The clinical course and development of the illness are unpredictable and can become either chronic or fulminant, including systemic reaction, toxemia or septic shock [13]. In NF type II in particular, the destructive path begins from the deeper tissues, and then spreads to the muscle fascia, as well as to the subcutaneous fat tissue due to its poor blood supply. The surface of the skin and the shallower tissue layers appear to be unchanged until the infection reaches the advanced stage, which makes the infection particularly dangerous and difficult to diagnose. If the above clinical symptoms do not raise suspicions in time, there is a high risk that the patient's condition will deteriorate dramatically, including the onset of septic shock or multiple organ failure [16]. Necrotic changes connected to serious metabolic disorders in the infected tissue are the basis for the further development of microorganisms, and this in turn results in rapid destruction of the tissue. The infection can spread at a rate of 1 inch per hour with minimal changes to the skin [8]. The clinical symptoms that should raise strong suspicions of NSTI during medical response team interventions are above all: sharp pain inconsistent with medical condition, hemorrhagic epidermal blisters, ecchymoses and petechiae under the skin (or within the skin), separation of dead tissue from live tissue around the wound (demarcation), loss of feeling in the skin, sudden onset of changes, gas blisters in the tissue – a symptom of crepitus (crackling under light pressure), necrosis of distal body parts (fingers, ears, nose) – meningococcal infection (streptococcal strain) [13].

The most common symptoms of NF are swelling (80%), pain (79%), redness (73%), bulging skin (25%), skin necrosis (24%) and subcutaneous emphysema (20%). In spite of the above data, NF is still difficult to diagnose during medical response team interventions as similar symptoms can also be observed in several other skin and soft tissue infections that do not place a patient's life or health in direct danger [9, 18, 19].

The symptoms mentioned above appear late in the course of a developed infection, and their occurrence has a highly variable symptomatology. A paramedic can suspect an infection in general by confirming a fever or hypothermia, rapid breathing and heart rate, hypotension or skin ecchymosis. Such suspicions require the patient to be transported to a hospital emergency unit, where they should be held in isolation until the pathogen is identified. According to the Infectious Disease Society of America (IDSA), patients with general symptoms of an NSTI infection should have the following tests in the hospital emergency unit: blood culture, a peripheral blood smear test to identify creatinine, bicarbonate, phosphocreatine kinase (CK), C reactive protein (CRP) and sodium levels [13]. The procedure for deciding whether a patient should continue to be isolated or not is a direct smear test as an initial microbiological assessment of the wound. The waiting time for the test result should not last more than 2 hours. An element of the diagnostic procedure is conducting a blood and skin aspirate culture, the result of which will enable the development of the infection to be determined. Particular emphasis should be paid to identification of the pathogen in the case of methicillin-resistant *Staphylococcus aureus* and Gram (-) bacteria [11-13].

SEPSIS AND SEPTIC SHOCK IN THE COURSE OF SOFT TISSUE INFECTIONS

Sepsis and septic shock occur irrespective of the patient's age, although the risk increases above 60 years of age. This dysfunction of the bodily organs is life threatening and is caused by impaired control of the body's response to infection [20]. Sepsis is a complex, multi-directional response by the body to external factors and is difficult to control, and can be compounded by endogenous factors [21, 22]. This specific individual reaction of the body to infection depends on the properties of the microorganism (type, number and pathogen virulence), as well as on personal factors (genetic, immunological, organ efficiency and concomitant diseases). These processes lead to changes in the body's functions, that is they activate the coagulation system with the possible development of intravascular coagulation, damage to cells including oxygenation disorders and endothelial dysfunction of the blood vessels. Endothelial dysfunction in turn causes the displacement of fluids from microcirculation, resulting in tissue edema, coagulation dysfunction and loss of blood vessel tension [23-25].

Criteria have been developed for diagnosis of sepsis organ dysfunction according to the Quick SOFA scale, which was created for pre-hospital diagnosis.

Prognosis is bad if the patient displays two of the three following symptoms: disturbance of consciousness (GCS < 13 pts), tachypnea > 22/min, hypotension with systolic blood pressure < 100 mmHg. An additional consultation, together with the results of the physical examination with the above symptoms, should draw the paramedic's attention to the possible presence of sepsis in the patient and the potential danger of septic shock [22].

The next tools helpful in recognizing sepsis are: Robson screening tools and the presence of two of the following symptoms: (body temperature > 38.3oC or < 36.0oC, disturbance of consciousness, tachypnea, tachycardia, glycemia > 120 mg%), as well as the Swedish algorithm BAS 90-30-90 and the presence of one of these symptoms: (breathing rate > 30/min, SpO2 < 90%, systolic blood pressure < 90 mmHg). In fact, paramedics can use both tools in combination with one another to identify the worrying symptoms of sepsis and septic shock. It must be remembered that this is merely an attempt and not a conclusive diagnosis [25].

It is vital in patients with suspected sepsis or septic shock for them to be transported immediately to a hospital emergency unit. It is also extremely important to commence treatment as quickly as possible. The patient should be put on two, large diameter 'intravascular access points' and intravenous fluid intake should be initiated. If the hypotension persists and there is no reaction to the intake of fluids, treatment should be begun with blood vessel decongestants [26].

TREATMENT OF SOFT TISSUE INFECTIONS

A key issue for medical response teams dealing with patients suffering from skin and soft tissue infection is to distinguish between infections that require immediate surgical intervention – a priority for paramedics, and those which only require preventative treatment. The strategy is principally based on early diagnosis, early surgical intervention, intensive fluid and oxygen intake, as well as intensive medical supervision with the use of targeted antibiotics against the specific microorganisms that have caused the infection [13]. The basis for treating patients with NSTI is urgent, and if necessary, repeated surgical intervention consisting of the removal of dead tissue (necrectomy, necrosectomy, surgical debridement) and draining secretions from the wound. Delay in this first intervention can worsen the patient's chances of survival. The first assessment and planned debridement treatment should take place no later than 12–24 hours after the first intervention. In some cases, amputation of limbs is unfortunately necessary [13, 16].

One of supportive treatments are hyperbaric oxygen and Negative Pressure Wound Therapy (NPWT) [5, 7].

ANTIBIOTIC TREATMENT

If necrotizing infections are diagnosed too late and treated incorrectly, this can encourage the selection of microorganisms resistant to antibiotics and their survival in the environment of the wound or in the tissues. The selection of antibiotics should depend on the severity of the infection and on additional factors affecting the development of the infection. Some authors suggest dividing patients with STI into four groups according to possible treatment:

1. Skin and soft tissue infections where the patient is in good overall condition, without fever or additional aggravating factors. Patients with the correct body mass, without diabetes or peripheral vascular diseases or chronic venous insufficiency.
2. Patients generally ill, with a fever and with at least one accompanying factor that can complicate treatment.
3. Severely ill patients with symptoms of tachycardia, increased breathing rate and hypotension, or patients without the above symptoms, but in an unstable condition with infections threatening the limbs.
4. Patients with serious life-threatening sepsis. This division principally determines the possible means of applying antibiotics, as well as for how long such therapy should last [14, 27].

In the first phase of treatment, use of antibiotics should be empirical and cover a spectrum of streptococci, staphylococci, Gram (-) sticks, and anaerobic bacteria. After about 48–72 hours into the treatment, the antibiotic treatment can be changed to targeted treatment according to the results obtained in bacteriological tests [13, 27]. As resistance to medication is a considerable problem, new antibiotics are required for the treatment of infectious diseases [3]. It is imperative that new generation antibiotics be constantly sought for. The process of pathogen mutation will certainly develop, which is why to combat this the search for new medication will undoubtedly continue [27].

CONCLUSIONS

Paramedics are the first link in the chain of medical care for patients with necrotizing soft tissue infection, which is why knowledge of the alarm symptoms indicating that immediate hospitalization is required is vital: inadequately severe patient con-

dition to the appearance of the wound, septic shock symptoms (discussed earlier), wound odor, type of secretion from the wound (pus, odorous sanious pus), advanced age, socio-economic situation indicating lack of care, access to basic public healthcare, alcoholism, drug addiction, accompanying diseases: (atherosclerosis, diabetes, collagen disease, condition after leg organ transplant with a wound in this area of the body, disability).

After considering the above factors, the paramedic should decide whether the patient requires immediate transport to a hospital emergency unit. If anaerobic bacterial infection is suspected, the procedure of isolation should then begin immediately. Although paramedics often face difficult circumstances when called to intervene, either because of the patient themselves and/or their surroundings, a detailed consultation and physical examination must be carried out. It must be remembered that failure to take the correct decisions regarding treatment and logistics can significantly reduce a patient's chances of survival. According to American standards, diagnosis of sepsis during NSTI is considered to be a threat on a par with a stroke or myocardial infarction.

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ORCID AND CONTRIBUTIONSHIP *
Michał Grzegorz Szlagor – 0000-0002-9020-3252 D
Rafał Bobiński – 0000-0002-3649-5653 F
Monika Mikulska – 0000-0002-5412-010X F
Tomasz Ilczak – 0000-0003-2478-9045 E
Michał Ćwiertnia – 0000-0001-9576-8095 E
Piotr Białoń – 0000-0002-9744-2678 B
Robert Kijanka – 0000-0003-1303-6734 B
Arkadiusz Stasicki – 0000-0002-4754-7308 B
Katarzyna Styrkosz – 0000-0003-4827-5583 B
Marek Kawecki – 0000-0001-9925-5297 A,E,F

ADDRESS FOR CORRESPONDENCE
Michał Grzegorz Szlagor
Katedra Ratownictwa Medycznego
Wydział Nauk o Zdrowiu
Akademia Techniczno-Humanistyczna w Bielsku-Białej
ul. Willowa 2, 43-309, Bielsko-Biała, Poland
e-mail: mszlagor@ath.bielsko.pl

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