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CASE REPORT

MASS CASUALTY INCIDENTS DURING THE TEN YEARS OF TELEMEDICAL MARITIME ASSISTANCE SERVICE IN GDYNIA, POLAND

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Abstract

Mass casualty incident (MCI) is one of the most difficult situation in emergency medicine. Due to the specific conditions, MCIs occurring at sea are usually far more demanding than those happening on land. In this paper the authors would like to describe the MCIs, which have happened during almost 10 years of functioning of the Polish Telemedical Maritime Assistance Service (TMAS). First incident concerned a group of migrants floating on a raft on the Gulf of Mexico. The cause of the second incident was acute organophosphate intoxication among the crew of the merchant ship. The third incident was triggered by the coronavirus disease 2019 (COVID-19). It is important to emphasize, that triage system may help in proper management of MCIs. Cooperation of the medical services, such as TMAS, local emergency medical staff, Search and Rescue (SAR) service and military force seems to be crucial in MCI managements occuring at sea. In case of any doubts, change of a course and heading to the nearest port or immediate evacuation should be taken into consideration. The authors believe that analysis of these incidents may help TMAS personnel all over the world to handle MCIs in the future. Med Pr. 2023;74(2):145–50

Key words: sea, telemedicine, seafarers, COVID-19, mass casualty incident, multiple victims

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INTRODUCTION

Working in marine transportation is considered dangerous. Seafarers experience more injuries, illnesses and fatal accidents than workers onshore [1]. To provide medical advice in case of emergency occurring at sea, telemedicine is being used.

The Polish Telemedical Maritime Assistance Service (TMAS) was established in 2012 at the University Center of Maritime and Tropical Medicine (UCMTM) in Gdynia [2,3]. The TMAS doctors provide expert medical advice in case of emergency on board for crew members of Polish nationality all around the world, as well as seafarers and civilian passengers within the Polish Search and Rescue (SAR) area of responsibility. Its duties are carried out 24 hours a day, 7 days a week by physicians working in the UCMTM [2,3]. Similar TMAS services operating in many regions of the world are important elements of global health security. All seafaring nations are required by International Labour Organization (ILO) convention number 164 of 1987 to organize TMAS in their country [4].

Mass casualty incidents (MCIs) is one of the most difficult situations in emergency medicine. It is defined as any event with number of casualties that vastly exceeds the local resources and capabilities of the local healthcare system [5]. The MCIs occurring at sea are usually far more demanding than those happening on land due to distance, location and limited evacuation means.

In this paper the authors would like to describe the MCIs, which have happened during almost 10 years of functioning of the Polish TMAS. The aim of this study is to analyze problems and difficulties that can accompany telemedical consultations of multiple casualties at sea. The authors believe that this knowledge may help TMAS personnel to handle MCIs in the future.

MATERIAL AND METHODS

This research is a retrospective case series study which outlines MCIs that have happened from October 2012 when the TMAS was established in Gdynia until December 31, 2021. Literature review in the MEDLINE database was also performed for discussion. The following keywords

Table 1. Short summary of causes of mass casualty incidents during 10 years of the Polish Telemedical Maritime Assistance Service (TMAS) [based on 6]

Incident	Casualties [n]	Cause of incident
First	7	– migration – weather conditions – improper mean of transport
Second	16	– mechanical factors (leakiness in the air conditioning ventilation trunk) – human factors (fault and neglect) – organisational factors (fumigation was carried out against the regulations laid down in the charter contract)
Third	3	– infectious disease

were used: mass casualty incident, multiple victims, sea, telemedicine, seafarers, COVID-19. Cases are described chronologically. A short summary of the causes of the MCIs is presented in the Table 1.

First incident

In January 2015 a Polish TMAS doctor on duty received a satellite phone call from a Polish ship informing about picking up 7 migrants (3 males and 4 females, all adults) from a raft floating in the ocean. The situation took place on the route between Cuba and Mexico. The medical interview was challenging to collect because of a language barrier. The migrants claimed that they had been floating for 6 days on a raft. The ship master asked TMAS doctor for recommendations. First of all the doctor advised to ask about any complaints to evaluate overall impression of the patients and to measure basic vital signs: temperature, heart rate and blood pressure. All migrants have complained about general fatigue, hunger and thirst. Two women were particularly weakened and dehydrated – they both presented tachycardia and subfebrile state. The vital signs of the rest of the group were within normal ranges. The doctor advised to remove all soaked clothes and to provide blankets and warm drinks to all patients. Moreover, the captain was instructed to administer electrolyte solutions parenterally for 2 most dehydrated women. Reporting to the Mexican coast guard in order to evacuate the patients was also suggested. The doctor recommended recontacting in few hours or sooner in case of any doubts.

Second incident

In September 2015 TMAS physician was called by the master of the Polish ship, that had been sailing near the Ivory Coast (Western African country) as 16 out of 17 seafarers on the ship began to experience symptoms such as stomach pains and vomiting with accompanying feeling of cold and weakness. The master informed the TMAS physician that these problems could have been caused by food poisoning as the crew ate fresh vegetables that the chef had bought earlier that day at the port of Abidjan. Due to a massive incident, the TMAS doctor suggested heading to the nearest port, to begin starvation diet and release the most affected crew members from duties. Additionally, based on the medication list provided via e-mail by the master, TMAS physician gave recommendations on liquids and pharmaceuticals that should be administered to the crew. The doctor also added, that it is necessary to supervise the crew, regularly monitor the state of consciousness and vital signs. After a few hours, the ship arrived at the roadster of the nearest port and the whole crew was examined by the local physician, who prescribed additional drugs and recommended resting.

After another few hours, the condition of the crew deteriorated and further-chief officer was found with no signs of life in his cabin. The master ordered to start the resuscitation. Simultaneously, the third officer started to experience breathing problems and blurred vision. She was given oxygen and also needed resuscitation afterwards. The captain immediately called the TMAS physician and the harbour master office and asked for emergency medical assistance. The TMAS doctor informed the Polish SAR team about the situation and asked them to contact the local rescue services. When the help arrived on board, resuscitation was continued, but eventually the arrival physician pronounced 2 seafarers dead. Then the ship moored to the port and the rest of the crew was evacuated to the local hospital. In 12 out of 15 patients acute phosphine intoxication was diagnosed, 8 out of 15 presented bilateral diffuse acute bronchitis.

This MCI was caused by improperly performed fumigation of the cargo and faulty ventilation [6]. In order to

evaluate the late health effects of this incident all seafarers were hospitalized 3 months later in the Department of Occupational Diseases and Environmental Health of the Nofer Institute of Occupational Medicine in Łódź, Poland [7]. Based on additional laboratory tests (elevated *aminotransferases*) and hepatologists consultation, 5 crew members were diagnosed with the state after a toxic liver injury due to acute phosphine intoxication and another one with the chronic hepatopathy of unknown etiology. The authors pointed out, that due to the lack of medical documentation from before the event, it was difficult to determine whether the organophosphates were the only factor causing liver damage. Moreover, 5 out of 15 patients suffered from posttraumatic stress disorder and adjustment disorders.

Third incident

The next incident took place in December 2020 and concerned 3 seafarers with coronavirus disease 2019 (COVID-19). The ship was moored in the port of Szczecin, Poland, when one of the officers experienced a fever (38°C). The coronavirus polymerase chain reaction (PCR) test was performed and the result was positive. The ship master called TMAS in Gdynia for recommendations. The doctor on duty asked about the symptoms and comorbidities of the patient. The officer suffered from runny nose and fever, had no comorbidities. Then the physician proposed to perform COVID-19 tests of the whole crew, to inform the local sanitary-epidemiological station about the situation and to isolate seafarers from each other. Furthermore, the master was instructed to provide a minimum of 2–3 l of fluid intake daily and to administer paracetamol in proper doses in case of a fever. Another 2 seafarers turned out to be infected with coronavirus as well. The master was instructed to regularly control vital signs of the crew and to recontact in case of any problems. The doctor also recommended evacuating any seafarer with dyspnea or persistent fever. In the following days, the master contacted TMAS 2 more times in order to inform about the condition of the seafarers, which was improving.

DISCUSSION

Between October 1, 2012 and December 31, 2021 Polish TMAS provided 349 medical advice, of which only 3 cases (0.86%) may be considered as MCIs (Figure 1).

However, the authors need to emphasize that during the COVID-19 (coronavirus disease 2019) pandemic, the incidence of MCIs might grow. As Kordsmeyer et al. [8] in their systematic review on outbreaks of COVID-19 on cruise, navy and cargo ships indicate, limited environment of a ship facilitate infectious disease transmission. Additionally, the authors of the mentioned review emphasize that such factors as limited access to healthcare, communication issues and high numbers of asymptomatic patients make managing of COVID-19 outbreaks very difficult. Using personal protective equipment (PPE) such as masks and gloves brings undeniable benefits in contact with a COVID-19 suspected crew member. It is important, that nowadays all crew members should be trained on how to use the PPE properly [9]. The methods limiting the spread of the infection on an isolated vessel should be adjusted to the means available on board. Rocklöv et al. [10] in their paper analyzed COVID-19 outbreak on Diamond Princess cruise ship, where 17% of all people onboard were tested positive. Using a mathematical model called SEIR (susceptible-exposed-infectious-removed) the authors estimated, that 79% of the passengers would have been infected without using any preventive measures. This proves that countermeasures including PPE, isolation of the infected individuals, providing professional medical consultations play vital role in limiting the number of infected passengers. On the other hand the authors add, that more cases could have been avoided if the evacuation of passengers had happened sooner. Only the symptomatic and confirmed positive patients were evacuated from the Diamond Princess cruise right away. It is debatable whether the decision to quarantine the ship members off the coast was correct. Taking into account the conditions on board that facilitate transmission

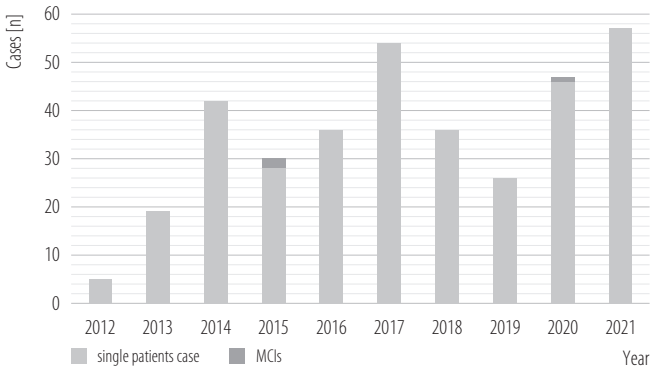

Figure 1. Amount of medical advices given by Polish Telemedical Maritime Assistance Service (TMAS) between 2012 and 2021 with distinction of single- and multi-cases incidents (MCIs)

of the virus such as shared cabins and sanitary facilities, high density of population, it is a big challenge to limit the viral transmission during quarantine of so many members of the ship crew and passengers [11]. This incident shows that seafarers and TMAS providers require further training and guidance to be able to deal with COVID-19 outbreaks on board more efficiently.

Mandatory vaccination against COVID-19 for seafarers should be taken into consideration due to its high efficacy in prevention of the disease [12].

The Italian TMAS service Centro Internazionale Radio Medico (CIRM) introduced in the era of COVID-19 a new triage system due to increasing number of multiple infections on ships [13]. The system is based on 4 color coded triage tags and its aim is to classify the intensity of self-reported symptoms by seafarers or passengers infected. The white color represents a mild case, the green represents a moderate case, the yellow indicates an urgent case and the red one represents a severe case. The triage system is designed to help TMAS physician to decide which victim should get help in the first place or who should be evacuated from the ship immediately.

The more information the medical professional receives from the vessel crew, the more accurate diagnosis of the patient can be established. External, visible symptoms can be photographed and sent via e-mail to TMAS doctor. Telemedical assistance with the use of photographic documentation provided by ship crew is widely described in the medical press and includes cases of wounds and dermatological diseases. Latournerie et al. [14] in their work analyzed the cases of acute wounds taking place during the cruise, which were consulted with French Tele-Medical Assistance Service between 2011 and 2019. Among 1006 patients consulted using TMAS 586 (58%) were evacuated from the vessels. One of the factors in keeping and treating a seafarer on board, beside the wound severity, medical training of the crew and ship location, was the availability of photographic documentation. Also Dehours et al. [15] in their paper describe benefits of photograph transmission for trauma management at ships. The authors claim, that teletransmission has become a vital tool in the French TMAS, helping in assessing and managing with wounds and burns.

Undoubtedly, the increasing role of telemedicine in providing medical advice for seafarers and passengers is visible. However, despite technological advantages, there are numerous limitations of these services such as lack of possibility to see or examine the patient in person, often incomplete medical data, limited availability of drugs and other medical devices when the ship is at sea [16]. These difficulties are exacerbated in the event of multiple casualties, where in some cases the physician has to decide about the order of providing help. Sagaro et al. [17] in their paper emphasize the need of application of advanced technologies such as high speed internet, video chat and electrocardiogram (ECG) teletransmission from sea going vessels.

Due to the fact, that cardiovascular diseases are among the most common causes of deaths among seafarers [18,19], automated external defibrillators (AED) and oxygen concentrators should be available on board [16].

The solutions known from the field of medicine may be also helpful – in the analysis published by Ryu et al. [20], concerning an accidental passenger ship collision in Korea, resulting in 114 casualties and 1 fatality, the authors emphasized an importance of triage system. Other authors such as Glassberg et al. [21] also highlighted the need for triage as well as coordination between all involved emergency services.

Some limitations of this study should be mentioned. The age of the subjects was not mentioned in the protocol accident report involving the raft survivors. The authors relied on accident records, which in this case contained incomplete data on the age of the victims.

CONCLUSIONS

An MCI occurring at sea is a challenging event, both for the crew and for the telemedical services. It is crucial to emphasize the importance of this study, because improper management of MCI may lead to many casualties. The MCIs at sea rarely happens, but with predicted growth of the maritime traffic, its incidence might grow. Considering that all the information about casualties is gained indirectly, a physical examination is usually performed by nonmedical personnel and there is limited amount and type of pharmaceuticals available on board, a medical training given to the crew has to be comprehensive. Brief interview and physical evaluation of patient by the crew might be insufficient to establish a proper diagnosis by TMAS doctors, therefore new technologies, such as video conferencing and ECG teletransmission should be implemented to help in differential diagnosis of subject's symptoms. In case of any doubts, change of a course and heading to the nearest port or immediate evacuation should be taken into

consideration. Taking into account the limited capabilities of the crew in relation to the number of casualties during MCI, a triage system may be the most appropriate tool that helps to avoid unnecessary evacuation and determine the correct sequence of assistance to subsequent victims. To sum up the authors would like to emphasize that cooperation of related agencies, such as TMAS, local emergency medical services, SAR and military services seems to be crucial in MCI managements occurring at sea. Cooperation between these units is necessary to ensure detailed and multi-directional care for the ship's crew in the event of a threat to the health and life of the crew.

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