REVIEW

First Aid during Civil Aviation Flights: Peculiarities in the COVID-19 era

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ABSTRACT

The rising average age of passengers, the chronic illnesses that passengers suffer from and the stress of flying are just some of the factors that contribute to emergencies in flight. Passengers at risk are those with heart or respiratory problems. Cardiopulmonary arrest, burns and gastrointestinal problems are the main reasons for first aid. The purpose of this review is to present the most common emergency health problems that may occur during a flight, as well as the first aid equipment available on the aircraft. To achieve this goal, a literature review of articles related to this field in Pubmed and Google Scholar databases was carried out in the period 2010-2020. Most conditions are treated by the crew with a simple painkiller. However, there are more complex conditions that require a different treatment, such as oxygen administration to patients with respiratory problems. In some cases, medical advice and assistance is sought from passengers who are healthcare professionals. Some companies require crews to be trained and certified every two years for the use of automated external defibrillators, as well as cardiopulmonary resuscitation. All aircrafts have an emergency medical kit with a limited number of drugs and universal precaution kit in cases where there is a risk of communicable disease. Due to the spread of COVID-19, the World Health Organization has issued specific guidelines for both protecting crews from the virus and treating a passenger who may have been infected with the virus.

Key-words: Aircraft, COVID-19, emergency health problems, first aid, flight.

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INTRODUCTION

The number of emergencies during flight is constantly increasing. This is linked to the steadily rising passenger traffic, the rising average age of passengers and the chronic illnesses that passengers suffer from. In addition, flight stress contributes to crashes in flight time (Mahony et al 2011). According to Sand et al (2009) it is reported that by 2030 the average age of half the passenger population will be over 50, while the changes in aircraft seating which provide them with less space as well as the safety stress of flying can cause more and more health problems.

There may be many emergency medical problems on the flight as the cabin pressure is maintained at 7.000-8.000 feet. Due to the compression of the cabin, passengers receive less oxygen compared to the ground, which can lead to hypoxia. Healthy people are not affected, however if a passenger has heart or respiratory problems they may experience severe discomfort. In addition, many passengers have gastrointestinal problems on the flight due to the different food and drink offered to them. Many studies have shown that heart failure, burns and gastrointestinal problems are the main causes for first aid (Kim et al 2017).

The term "medical incident on a flight" refers to a series of illnesses that range from simple headaches to deaths during flight. Most of the incidents are treated by the crew with a simple painkiller. However, there are more complex conditions that require a different approach, such as administering oxygen to patients with respiratory problems. In some cases, medical advice and assistance is sought from passengers belonging to the industry (Mahony et al 2011).

It is estimated that 44.000 cases occur during a flight in one year. However, most cases are treated without disturbing the flight by the crews themselves, using the equipment provided by the aircraft (Peterson et al 2013).

Kodama et al (2018) report that a study of data from a medical consulting firm that serves airlines on the ground in North America showed that the occurrence of a flight emergency is estimated at 16 accidents per one million passengers. A similar survey in Europe, following in two years, resulted in 1.312 incidents on 10 million passengers, or 1 in 77.000 passengers. The top five most common health problems occurring on the flight are syncope (37.4%), respiratory problems (12.1%), nausea or vomiting (9.5%), heart problems (7.7%) and panic attacks (5.8%). However, it is difficult to determine the "emergency" in flight as data from airlines are incomplete (Kodama et al 2018).

From 2009 to 2013, 2.818 cases were reported, and the incidence of emergencies per 1 million passengers increased from 5.2 in 2009 to 52 in 2013. First aid from crew members was given to 1,471 cases, the most common causes being injuries and burns. In addition, they analyzed 2471 cases that required follow-up after the flight. In 1215 cases where first aid was provided by cabin crews, 1,086 cases were resolved during the flight, while only 129 had to be transported to hospital, which led to the adequacy of the crews in providing first aid (Kim et al 2016).

TRAINING OF CABIN CREWS IN PROVIDING FIRST AID

Providing first aid on the plane is not easy. The medical procedures at 38.000 feet and while the patient is in a sitting position makes it even more difficult. The conditions of the aircraft make the diagnosis often impossible. The use of a stethoscope is often not possible, the atmosphere is noisy and the cabin light does not give a clear picture of the patient. Transferring the patient to a hospital may take hours until the aircraft lands and the patient is transported. That is why there are cabin crews trained to provide first aid on the aircraft with all the means at their disposal (Cocks 2007).

IATA is requesting that cabin crews should be trained in first aid. However, each company follows its own rules in employee training. In other words, no specific way and time of training is provided. At this point, it should be emphasized that airlines cannot have a doctor on a flight by flight basis, so they rely on volunteers (Ruskin 2009).

The administration of the federal aviation authority defines as a basic part of the crew training the coordination of crew members to manage an emergency, the knowledge of the pharmaceutical material and equipment of the aircraft, their use and location. Some companies require crews to be tested every two years for the use of automated external defibrillators, as well as cardiopulmonary resuscitation. In this training, it is considered that flying attendants cannot have the same knowledge as healthcare professionals (Ruskin 2008).

The European Union Aviation Safety Agency (EASA), through legislation, stipulates that the training of cabin crews must include:

1. The physiology of flight, including oxygen and hypoxia needs.
2. Emergency treatment in aviation including: asthma, choking, heart attack, allergic reactions, panic attacks, shock, stroke, epilepsy, diabetes, hypothermia, gastrointestinal disorders and emergency delivery.
3. The application of cardiopulmonary resuscitation using a mannequin taking into account the environment of the aircraft.
4. Basic survival first aid training including care in

case of burns, wounds, fractures and soft tissue injuries.

5. Travel health, which includes the risk of contact with infectious diseases, especially when the company operates in tropical and subtropical regions.

In addition, crew training includes on-board hygiene, death on the aircraft, handling of clinical waste, disinfection of aircraft and management of fatigue, difficult schedules, sleep physiology and time zone. Finally, the use of aircraft equipment, including first aid kits, emergency medical supplies such as oxygen, is part of the training (EASA EU-OPS 1.1005/1.1010/1.1015). In a Downdall study, three-quarters of emergency flights were handled by crews without the help of healthcare professionals (Cocks 2007).

In the event of an injury or illness during a flight:

1. Call for emergency assistance if available from the company.

2. Seek the help of a healthcare professional or volunteer if they are on the flight.

3. If there are no healthcare professionals on the plane, follow the procedures listed on the first aid kit.

4. Make the passenger feel comfortable.

5. Provide oxygen if instructed in the first aid kit or recommended by a healthcare professional.

6. Write in the flight report:

a) The name of the passenger

b) The condition of the passenger and the symptoms he had

c) If a stretcher or wheelchair is required when disembarking

d) The medicines given.

Finally, in case of suspected infectious disease, the captain should be informed and additional procedures should be followed (IATA 2018).

Airlines are ubiquitous on the plane as they participate in all emergency flights. Not only are they trained in first aid and cardiopulmonary resuscitation, but in many companies, they are now also using the automated external defibrillator. They are the ears and eyes of the cockpit in the cabin and they are the ones who immediately transmit the information to the captain to make the right decision. They also help recruit volunteers, while creating space for better patient management (Kodama et al 2018).

The American Heart Association advised that the planes should be equipped with an automated external defibrillator as the patient's survival after a heart attack is around 74% if used within the first three minutes. That's why long-haul planes began placing the defibrillator on aircraft, and crew training began. Since 1991, British Airways, Qantas, Virgin Atlantic and American Airlines have installed the defibrillator on their aircraft. The successful selection of this intervention in flight is shown by the data collected by Qantas, as they successfully treated five of the six cases of heart failure (Offerrer et al 2002).

However, according to Mahony et al (2007) there are currently no internationally agreed standards for the training of cabin crew members, with the result that other companies are training their crew members more adequately. It is worth emphasizing that there is a large variation in terms of duration and content.

LEGAL RESPONSIBILITY FOR FIRST AID IN FLIGHT

The most common cases reported during a flight are respiratory problems, nausea and symptoms of the cardiovascular system. As mentioned, they are usually successfully treated by crews or flight health professionals. However, taking responsibility for any incident in the air is great as there may not be the necessary means to deal with it and the consequences may be very serious for the patient's health. The legislature has envisioned a good Samaritan law in 1998, protecting people who volunteer to provide assistance as well as cabin crews themselves, recognizing that they are not doctors and do not have the necessary means or education (Peterson et al 2013).

IATA, in order to avoid legal liability for any death in flight, first aid covers passengers, whether they are health professionals or not (e.g. Red Cross volunteers), with the above law. This law stipulates that an individual cannot be charged or prosecuted for attempting to provide first aid on a flight, unless there is fraud in his actions. In addition, the law protects the provider from omissions that are characterized by simple negligence. Simple negligence is defined as "not using standard of care or not being able to exercise due to limited means" (Bukowski 2015).

Volunteering in first aid as mentioned is acceptable, but subject to conditions. Healthcare professionals need to evaluate their condition well before doing anything. They must not have consumed alcohol or sedatives. Healthcare professionals who take action must assure the captain that continuing the journey will not harm the sick or injured passenger and that the safety of other passengers (in the event of a communicable disease) is not compromised (Ruskin et al 2008).

In order to understand the importance of volunteers in flight, it is enough to mention the fact that the treatment of emergencies by volunteer doctors is around 40%-50%, by volunteer nurses 5%-25%, while cabin crews are treated only 45% of cases (Kodama et al 2018).

FIRST AID ON THE PLANE

The development of first aid in aviation

The evolution of first aid in the field of aircraft has

changed radically over the years as until 1997 there were no international standards. According to Jagoda and Pietrzak, one of the most shocking stories in aviation history in relation to first aid on the plane occurred in May 1995 and was the reason for their development. A female passenger on British Airways felt severe breathing difficulty combined with cyanosis. Two doctors, passengers, diagnosed a pneumothorax and, using a scalpel, a knife, a fork, a hanger, a urine catheter, brandy and water, successfully placed an endotracheal tube to decongest the pneumothorax. After this incident, the passenger public began to wonder what resources would be used by other companies (Jagoda & Pietrzak 1997).

There were no international standards for medical equipment and medicines that each company was required to have on its aircraft, and there were no international standards for first aid training for cabin crews as crews were nurses at the beginning of aviation (Jagoda & Pietrzak 1997).

Now ICAO (International Civil Aviation Organization), the international civil aviation organization, which is a specialized service of the United Nations and is responsible for creating rules that regulate the safety of flights internationally, has taken care of exactly what aircraft should have. This is done by establishing international standards, which are then applied by each country. An ICAO standard, which is mandatory for all airlines for medical flight events, establishes adequate medical supplies for medicines and materials. It is worth noting that the ICAO standards, if not applied by all companies, then receive similar sanctions. Specific requirements for companies are determined secondarily by the relevant national aviation regulatory authority. ICAO determines the number and types of kits, which are similar in all airlines, in terms of substances. The content of the kits, however, may vary depending on the national aviation regulatory authority to which each company belongs. For international travel, IATA and ASMA recommend the same content (ASMA 2018).

First Aid Kit (FAK)

In 1998, IATA, in collaboration with the Air Transport Medicine, recommended that the Civil Aviation Authority have an emergency medical kit (Figure 1), with a limited number of medicines, so that cabin crews could provide basic first aid. This was revised in 2002, when the kit included additional drugs, which are used exclusively by a health professional who may be on the aircraft. Drugs on the kit can treat the most common serious illnesses, such as an allergic shock in flight, until the plane makes a forced landing at another destination (diversion) to be picked up by the passenger by the emergency care services (Thibeault et al 2007). The kits, according to IATA, must withstand adverse conditions, their packaging must be made of hard materials, so that cabin crews can use them in emergencies, such as the evacuation of aircraft and remain unchanged (IATA 2018).

Picture 1. First Aid Kit

A research which conducted by two European airlines highlighted the most common incidents during a flight, helping companies to know the percentage and types of incidents they will be called upon to deal with. However, he points out that there is a lack of data on the number of illnesses caused by passengers during flight, which does not help aviation in general, so that aircraft can supply the appropriate drugs and not have unnecessary equipment (Ruskin 2009).

The FAKs that all aircraft must have as formulated by IATA must contain the following as shown in Table 1 (IATA 2018):

Antiseptic coatings (10 packs)	Adhesion of adhesive strips
Bandage, gauze 7.5 X 4.5 cm	Double sided cover 100 cm
Bandage for burns 10 X 10 cm	Sterile gauze 7.5 X 12 cm
Sterile gauze 10.4 X 10.4cm	adhesive tape 2.5 cm
Plastic stitches	Padme shield or eye tape
Scissors 10 cm (if permitted by applicable regulations)	Surgical adhesive tape 1.2 cm X 4.6 m
Tweezers	Resuscitation mask with single-way valve
First Aid Manual (the carrier may decide to have one manual per aircraft in an easily accessible location)	Incident recording form

Table 1. The First Aid Kid

The first aid kit should not include ammonia inhalations. It should be noted that since some countries do not allow any medication to be taken on the first aid kit, some airlines carry an extra kit containing medicines used at the request of the passenger. The crew may not suggest that the passenger take any medication, whatever it may be, as the passenger may develop an allergy if he has not taken it again. This kit usually includes medications such as: mild to moderate analgesic for adults and children, antiemetic pills, nasal decongestant, antihistamine pills, pills for food poisoning or diarrhea (IATA 2018).

Universal Precaution Kit

In case a passenger vomits in the area of the aircraft outside the toilet (seat, corridor-carpet) and there is a risk of contagious disease, IATA has provided the universal precaution kit (Figure 2). It is a necessary equipment of the aircraft and includes the following as shown in Table 2 (IATA 2018):

Dry powder envelope that turns vomiting into granular gel	Disinfectant wipes for cleaning surfaces
Antimicrobial face mask	One-use gloves
Absorbent towel	Scraper collection scraper
Biological hazardous waste bag	Instructions for use

Table 2. Universal Precaution Kit

Picture 2. Universal Precaution Kit

Emergency Medical Kit

Due to the increased number of emergencies during the flight, the many hours a trip can take and the time it takes for an aircraft to land, especially if the trip is, for example, transatlantic, many airlines have increased medical care with the emergency medical kit that even contains an automated external defibrillator (Thibeault 2015).

This kit is based on the recommendations of the Aerospace Medical Association (AsMA). This kit is checked before each flight and if it is not sealed there is a possibility that the flight will not take off as it is considered a non-go item (Chandra 2013). As a non go item, a part of the equipment is defined, in the absence of which the flight cannot take place.

IATA in the last revised manual of 2018 announced a list of what the kit should contain, provided that this kit is used only by healthcare professionals and is spatially located in the cockpit, so that there is no possibility of access by unskilled people (IATA 2018). The contents of the emergency kit are shown in Table 3:

Electronic sphygmomanometer	Stethoscope
Oropharyngeal airway (various sizes)	Syringes (of various sizes)
Needles (of different sizes)	Intravenous catheters (of various sizes)
Intravenous fluid supply system	Antiseptic wipes
Venous tourniquet	One-use gloves
Urine catheter with sterile lubricating gel	Sponge-gauze
Tape Tracheal emergency catheter or large-scale intravenous tube	Surgical mask Umbilical cord clamp
Thermometer	Lens and batteries (operator can choose to have one per aircraft in an easily accessible location)
Adult rejuvenation bag	Basic life support cards

Table 3. Emergency Medical Kit

Note: the transfer of an automated external defibrillator will be determined by the operator based on the risk of evaluation, taking into account all relevant factors (IATA, 2018).

The most significant changes in the substance of the aircraft were made in 2002. In particular, glucose is not available in many countries, so the term "equivalent" was added to make it a drug. Intravenous analgesic has been replaced by oral administration, as oral analgesia covers most emergencies and can be given by the crew as opposed to intravenous. Lidocaine has been removed from the list, as research has shown that it is not and will not be used in the future based on current protocols. Glucose control strips were removed from the aircraft. If first aid is needed in a diabetic, it is done with drinking sugar or glucose. An analgesic is allowed in a kit that is accessible, such as the first aid kit, in countries that allow it (Thibeault 2007).

The amount of kits that aircraft must have is determined by the number of seats they have and not by the number of passengers on the flight. There should be one first aid kit per 100 seats. The universal precaution kit should be one but companies operating flights to countries with increased infectious diseases can have whatever they want. Finally, the emergency kit is one. Companies cannot deviate from the law. However, it is up to them if they want to have more, but certainly not less than expected (ICAO 2019).

Proper use of kits depends on four factors. First, the level of knowledge of the kit user must be evaluated. In addition to legal parameters, the aircraft environment is a deterrent to proper diagnosis due to noise and vibration. Therefore the user should be able to know how to operate under these conditions. The choice of medication should not exceed the diagnostic capacity of the doctor on the flight, which in turn is limited to the area of the aircraft due to the equipment provided. Even the terminology of the substances should be common worldwide as the kits are potentially used by different nationalities. The kit must be in a safe place so that passengers do not have eye contact or contact, as it is not uncommon for passengers to steal their equipment from the plane, such as life jackets or belts. In addition, the procedures for terminating or updating the content should be specified by the company. Finally, before opening the kit for use, the crew should make sure that the person using it is indeed a doctor or healthcare professional, as many passengers falsely claim to be doctors. This can be checked from the list of passengers, as many state their status as evidence (Mills & Harding 1983).

In addition to kits, aircraft are required to have oxygen cylinders. The bottles have a capacity of 120 and 310 liters and are provided with a mask which is connected to the bottle. This mask is -almost similar to the one that falls in front of passengers from the fuselage in case of decompression. Oxygen supply is based on high (high) 4l /minute and low (low) flow of 2l / minute (Kodama et al 2018).

Land assistance process

Most airlines, and especially airlines that travel long hours and cross the ocean, where it is difficult to land immediately, have an underground center to provide medical assistance. The same companies cannot rely on the possibility of a doctor on the flight and have twenty-four hours of medical help at their disposal. These doctors have been trained to provide adequate and detailed information on medications or the procedure that crews must follow during an event. When this happens, crews and flight health professionals help (Gendreau & De John 2002).

Delta has signed a contract with the University of Pittsburgh for such situations. Most companies, however, are served by the telemedicine support service for aircraft, such as MedAir. In case of intervention by a MedAir doctor, the captain does not necessarily obey the orders to divert the flight to another airport for the immediate transfer of the passenger to a hospital, as it may endanger the lives of other passengers due to the weather conditions, which may prevail at the airport of compulsory landing. At the time of communication, MedAir informs the captain of the nearest airports and medical facilities based on the data they have. It is worth noting that MedAir has data for more than 5.000 cities worldwide. This helps to allow the flight to be diverted immediately, if necessary (O' Ferrer et al 2002).

In a study of 32 European airlines from 2002 to 2007, only four were able to provide such data for research with similar medical reports, while the rest did not accept it for political reasons. These data showed that out of the emergency situations recorded only 279 flights out of a total of 10.189 patients were diverted. During 2007, the 58% diversions were on intercontinental flights, while 42% were on flights within mainland Europe. The most common causes of diversion were myocardial infarction (22.7%), stroke (11.3%) and seizures (9.4%). In the same year, according to the survey, the percentage of doctors-passengers who were present at the diversion of the aircraft was 77.4% (Sand et al 2009).

The availability of such a service, benefits the avoidance of unnecessary diversions of flights, which in addition to being time consuming and inconvenient for other passengers are also extremely expensive for companies. However, the final decision is always up to the flight attendant. It is worth noting that terrestrial assistance reduced flight deviations to 70% (Gendreau & De John 2002). Deviation of an aircraft to another destination is recommended mainly when the patient reports incessant chest pain, shortness of breath or uninterrupted abdominal pain (Ruskin 2008).

The process of talking to the treating physician is done according to the procedures followed by each company. One way is through satellite, where the conversation with the treating physician is immediate. The other way is by connecting a crew member, the doctor and the cockpit, using a written telemedicine list (Kodama et al 2018).

INSTRUCTIONS FOR COVID-19

Due to the spread of COVID-19, the World Health Organization (WHO) in collaboration with ICAO, has issued specific guidelines for both the protection of crews from viruses and the treatment of a passenger

who may have been infected. According to WHO, the virus is transmitted from person to person through droplets entering through the respiratory tract, or through direct contact with an infected person (WHO 2020).

Due to the spread of this virus, additional equipment has been added to the aircraft, including dry powder that converts liquids into sterile granulated gel, disinfectants and alcohol wipes for cleaning, life jackets, aircraft masks, face masks. It is also recommended that crews wear long-sleeved uniforms if available, otherwise wear a cardigan (WHO 2020).

WHO guidelines state that if a passenger develops, during a flight, symptoms of an acute respiratory infection or shows symptoms compatible with a communicable disease, including that virus, efforts should be made by the crew to make close contact with as few people as possible. The instructions given to the crews by IATA are to separate the patient from the other passengers, at least one meter or to have two empty seats in all directions from the infected passenger and therefore to change the seats of the adjacent passengers wherever they are possible. In addition, the sick passenger should be asked to wear a medical mask and be especially careful when sneezing or coughing. If the mask is not tolerated by the passenger throughout the flight, then the crew must provide him with tissues to cover his mouth and nose. The used tissues should be thrown in a specific bag for biological hazardous waste. In case of not having the appropriate bag, the crews should use a plastic bag which should be tied tightly and then wash hands thoroughly. The crew must be very careful not to touch other objects used to serve passengers, if they had not been washed (WHO 2020).

This particular passenger should only be served by a crew member, who should, as far as possible, be trained in preventive measures, always using virus self-protection measures (mask, gloves) to reduce the likelihood of dispersal of the virus to more people. In addition, a specific toilet must be designated for use by that particular passenger (WHO 2020).

CONCLUSIONS

During routine flights, various emergencies can occur in patients, such as cardiopulmonary arrest, burns, and gastrointestinal problems. Most conditions are treated by the crew with a simple painkiller. However, there are more complicated situations that need a different approach. In some cases, medical advice and assistance is sought from passengers who are healthcare professionals. The conditions of the aircraft make the diagnosis often impossible. Pilots and flight attendants are required by airlines to participate in first aid training programs. All aircrafts have an emergency medical kit with a limited number of drugs and a kit to reduce the spread of communicable diseases.

Due to the proliferation of COVID-19, additional equipment has been added to the aircraft, including dry powder that converts liquids into sterile granulated gel, disinfectants and alcohol wipes, life jackets, airbags, face mask, while crews are still advised to wear a long-sleeved outfit if available, otherwise wear a cardigan.

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