Cardiopulmonary resuscitation-related complications. An essential approach to rescuer’s liability in Greece

Aspasia Deliligka 1, Polychronis Voultsos 1, Alexandros-Anastasios Garyfallos 2, Alexandra Enache 3, Fotios Chatzinikolaou 1,*

Abstract: Cardiopulmonary resuscitation (CPR) is a life-saving medical practice with particular characteristics. On time initiation of CPR can increase survival in cases of sudden cardiac arrest. The main component of CPR is the application of external chest compressions. Unfortunately, bystander CPR rates have remained low over the past decade. The unwillingness has been attributed to various causes among which complications are discussed in this paper. Complications of cardiopulmonary resuscitation often occur even if the doctor is skilled and acts according to the guidelines. The iatrogenic manipulations of CPR contain a significant violation risk for both the patient and the physician. The scope of this paper is to review the main complications of cardiopulmonary resuscitation and the discussion of the points that characterize the ethico-legal approach of these complications. The ultimate objective is the prejudice of negative “defensive medicine” so that all doctors will not avoid the application of CPR, fearing malpractice litigation.

Key Words: Cardiopulmonary resuscitation, complications, ethico-legal.

Sudden death from cardiac arrest is a major medical issue and one of the biggest people's fears. The chain of Basic Life Support is the only way to improve the survival and includes early access and on time implementation of basic cardiopulmonary resuscitation, defibrillation and advanced care [1].

According to the American Heart Association, cardiac arrests are more frequent than commonly believed, and they can happen to anyone at any time. From 1997 to 2007, the death rate from cardiovascular disease (CVD) declined to 27.8%. Mortality data for 2007 shows that CVD accounted for 33.6% of all 2,243,712 deaths in 2007, or 1 of every 2.9 deaths in the United States [2]. 73.4% of out-of-hospital cardiac arrests occur at a private location (victim’s home, the homes of the victims’ relatives or friends) so the life saved with CPR is mostly likely to be a loved ones: a child, a spouse, a parent or a friend [3, 4].

Any trained bystander should be encouraged not to refrain from rendering assistance (performing CPR) in an emergency (cardiac arrest) for legal liability reasons, especially in countries where are missing the so-called “Good Samaritan” laws that immunize the actions taken by a bystander to provide first aid in an emergency scene.

Cardiopulmonary Resuscitation
Since 1960, when it was first discovered by Kouwenhoven, until today, CPR has undergone several modifications [5]. However, the main purpose still
remains the technical support of cardiac and respiratory function for immediate oxygenation of the brain, heart and other vital organs. CPR is distinguished in Basic and Advanced Life Support [6].

The indication for the application of CPR is when the victim is unresponsive and not breathing. An important concern is the maintenance of an open airway for breathing which is achieved by lifting up the chin gently with one hand while pushing down on the forehead with the other to tilt the head back. Following, ventilation of the patient is accomplished by blowing air into the airway. The main component of CPR is the application of external chest compressions. The recommendation is to place the heel of the dominant hand on the sternum while the other hand is placed on top of that and start pressing downward, depressing the sternum, hard and fast, and holding the arms straight. Chest compressions should be applied with a certain frequency and at a certain depth [7].

Through the cooperation of large scientific organizations, new updated guidelines are issued every five years, in order to treat better and safer the victims of sudden cardiac arrest, inside and outside the hospital. According the new 2010 guidelines by the European Resuscitation Council (ERC), all rescuers, trained or not, should provide chest compressions to the victims of cardiac arrest pushing to a depth of at least 5 cm at a rate of at least 100 compressions per minute. Trained rescuers should also provide ventilation with a compression–ventilation (CV) ratio of 30:2. Telephone-guided chest compression-only CPR is encouraged for untrained rescuers [8].

The knowledge for the implementation of Basic Cardiopulmonary Resuscitation is necessary, even for the non-specialists, because it is simple and it is accompanied by an increased survival. The survival rate ranges from 2% to greater than 20% [9].

Revitalization efforts are applied to victims of cardiopulmonary arrest until adequate spontaneous circulation is achieved or until death is noted [10].

Unfortunately, bystander CPR rates have remained low over the past decade, rarely exceed 20% [11].

It is clear that there is unwillingness of applying CPR which is greater for the mouth-to-mouth air ventilation rather than the chest compressions. Family members are less likely to perform CPR and out-of-hospital cardiac arrests that occur in the presence of family members are less likely to survive [12]. Cardiopulmonary resuscitation can produce considerable stress, and the experience of stress and overload may impair performance [13].

The main reasons for the unwillingness among people to perform CPR are inadequate knowledge and/or doubt regarding whether they could perform the techniques effectively, the fear of disease transmission and the fear of complications [13, 14].

**Complications**

Resuscitation attempts require invasive iatrogenic manipulations on the patient which are essential for survival. Nonetheless, these manipulations can damage the patient, containing a significant violation risk, of both medical and forensic relevance, for the patient and the physician. Resuscitation-related injuries have been differentiated between frequent and rare. Factors of influence comprise the duration and intensity of the resuscitation attempts, sex and age of the patient as well as an anticoagulant medication [10].

The most common complication of resuscitation efforts is fractures of the sternum and ribs at a rate of 13-97% [16–19]. Other common complications are bruising and abrasions in the neck region, injuries of the teeth, lesions of the mucous membrane of the trachea and retropharyngeal haemorrhage. Rare and very rare complications are fractures of the hyoid bone and thyroid cartilage, injuries of the nerves, vocal cord lesions, lacerations of the intimal carotid, cardiac rupture, aortic rupture and rarely lesions of the abdominal organs [10].

The complications that can arise from the application of CPR are confronted by the existing legal system as a medical error, as in the performance of any medical procedure with adverse outcome. The main points which characterize the ethico-legal approach of the complications of CPR that is worth of commentary are:

1. The risk of the medical practice. CPR has been described as "a violent, damaging, painful, alarming and undignified intervention" [20]. In the case of cardiopulmonary resuscitation, it has been shown that adequate compression depth of the chest is of utmost importance to increase the likelihood of achieving spontaneous circulation. The European Resuscitation Council changed their recommendation for the minimum compression depth of 2005 (40 mm) to 2010 (50 mm) [7, 8]. The quality of chest compressions improved significantly since the 2010 guidelines from the American Heart Association [21]. However, the increase in compression depth could increase the potential for bleeding and fractures which can be further complicated with visceral lesions. But according to the Greek legal theory, the risk of an operation and the vulnerability of the patient warrant a higher standard [22]. However, it is more difficult for the rescuer to meet the guidelines because of the increased fatigue.

2. Compliance with the guidelines in emergency conditions. CPR is applied in victims of cardiac arrest, i.e. in emergency conditions. Therefore, more cardiac arrests occur outside the hospital setting [3]. According to the Greek Medical Ethics Code, (article 9, paragraph 3) the physician must provide services for emergency response regardless of speciality. This obligation is a "special legal
obligation” that applies to the doctor, even when there are no adequate means for the practice of medicine, and it is valid until the referral of the patient to an appropriate specialist physician or transportation to a suitable unit of care services. In any case, the physician must exhaust the existing, under the circumstances, capabilities, according to the requirements of medical science. Under conditions of emergency, the physician becomes a guardian of victim’s life. In case that the physician refrain from rendering medical help in emergency, her (intentional or negligent) omission is legally (criminally) equivalent to action (intentional or negligent, respectively) (article 15, Greek Penal Code).

Furthermore, the possibility that CPR will be performed to a familiar person, which makes it possible for the physician to be emotionally charged in performing his work is really important. (4) But even if the victim is not familiar to the doctor, there are many cases in which CPR is provided during family presence and that might cause increased emotional stress to the medical staff [23].

Rescuers may be in danger of losing control over their own (muscular) actions due to high psychic pressure and fatigue.

3. Difficulty in differentiating the negligent by the not negligent behaviour. The boundaries between diligence and negligence in the performance of CPR, despite compliance with the guidelines, are unclear. This ambiguity is due to both the nature of the medical procedure and in the emergency conditions under which it is applied, as mentioned earlier. It therefore appears that serious injuries can occur even without a breach of guidelines.

4. Difficulty in distinguishing the forms of fault. The incidence of complications varies with the age of patients and it is small at an early age, increasing in older people. Due to the fact that when a doctor performs CPR, he “knows” the high probability of complications and accepts them either as unavoidable (when the probability approaching certainty) or as possible, he/she can be said to have indirect or conditional intent, respectively. Nonetheless, the unjust nature of wilfully committed bodily harm (which can be dangerous or heavy) is lifted on appeal by the provision of the Greek Penal Code for the emergency situation which precludes the inequitable (article 25) as the legal right of life is “significantly higher” in the “type and importance” from limb. However, if the possibility of complications is low (e.g. child or teenager) the unjust nature of the behaviour that caused them remains. In such a case it is rather about a reckless.

5. Difficulty in foundation of the causal link. After a cardiac arrest incident, the successive cooperation of two or more persons (convergent action) is really often. This collaboration of medical personnel may involve other physicians, qualified paramedics personnel or bystanders (unskilled workers). The German legal theory distinguishes between two types of distribution of convergent responsibility: horizontal and vertical. Horizontal distribution is when the cooperation regards to specialists. Vertical distribution of responsibility is when the cooperation regards to hierarchically related health care providers: in collaboration with specialist doctors to training ones, physician to nurse and physician to specialists. The principle of “trust” and the principle of “the unsafe action” are usually applied, both principles of criminal law that everyone does not need to take account of the potential fault of another, unless there is strong evidence for such a possibility. Everyone, however, is responsible for the field of his action [22]. In such a case, a genuinely fair and just attribution of liability is difficult to obtain.

6. Forensic differentiate and ethical problems. Several incidents have been published describing rare cases of complications of CPR in both adults [17, 24] and in children [25]. A few cases have also been published where the State filed murder charges against the rescuer [26]. The above facts show that the intervention of a doctor even in a case of cardiac arrest can lead him to the court. Increased attention is required to the examination and interpretation of lesions and in preparing the forensic report as this can have dramatic consequences for the rescuer. The coroner may, however, reach in a state of dilemma regarding disclosure or concealment of injuries due to CPR in order to avoid lengthy and legally difficult battles for fellow practitioners who acted as required by medical task.

CONCLUSION

It is true that excessive legal threat to the physician ultimately hinders the practice of medicine since it leads to the so-called “defensive medicine” which has undesired consequences for both patients and insurance funds. For this excessive legal compression against physician, the workaround medical error from both the law and the administration of justice is significantly important, which indeed often ignores the humanitarian element of the doctor-patient relationship. The doctor, in the context of defensive medicine, may hesitate to take decisions and act more actively in some difficult and borderline cases. For this reason it is proposed:

1. The special treatment of complications of CPR by Justice as it is a singular and unique medical practice. Unwillingness to one act in an emergency cardio incident may lead to unnecessary deaths. Effective CPR provided by bystanders immediately after a sudden cardiac arrest can double or triple a victim’s chance of survival.

2. The intensification of research to determine the acceptable and unacceptable complications from the application of CPR.

3. The compulsory theoretical and practical training in CPR for all medical students so that every graduating doctor already knows guidelines of this
salutary medical practice and the coordination and maintenance of continuous education to be fully informed of developments.

Conflict of interest. The authors declare that they have no conflict of interest concerning this article.

References