Cardiopulmonary Resuscitation (CPR) and Its Ethical Aspects

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ABSTRACT
Despite of relatively old history, modern CPR was introduced in early 1960s and very soon became a default treatment in the world. Generally CPR aims to ensure circulation of oxygenated blood. Although CPR seems to be a non-expensive treatment, considering its indirect financial burden shows that it is generally expensive intervention when calculating its financial consequences for both patients and health system. CPR includes invasive components and usually is followed by serious morbidities. In addition CPR outcomes are relatively low and public and even professionals usually overestimate CPR outcomes. Media are known as one of the sources of such overestimations. Attempting CPR has ethical dimensions that are those regarding the risks of CPR for the rescuer, the public moral responsibility for out-of-hospital CPR, presence of family during CPR process, ethical issues of CPR research and finally, the principle of justice implications for providing emergency medical service for different parts of the country by the government.

Keywords: Cardiopulmonary Arrest, Resuscitation, Medical Ethics

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Introduction
One of the most dramatic and influential innovations of modern medicine is CPR. The use of word, resuscitation, in the 14th century was more for resurrection of the body, soul, or both. In the 17th, it began to refer more exclusively to the body and later in 19th century was used for the act of rewarming techniques and manual artificial ventilation¹. The first recorded resuscitation attempt was in 17th century by William Harvey on animals². Although Western medical texts usually try to connect the roots of human resuscitation to the Biblical story of Prophet Elisha as the first documented trial of mouth-to-mouth ventilation, the history of modern CPR returns to late 18th century that some organizations had
been established for saving the life of victims of drowning in Amsterdam and London. In 1898, for the first time in a French hospital ward, the heartbeat of a patient who underwent surgery was restored successfully. Later pharmacological advancement such as using adrenaline and procaine promoted the likelihood of resuscitation attempts in the 1940s. The idea of prone-pressure method (face-down position) was introduced in 1889 by Schafer and became the accepted method in the first half of the 20th century. Obstetricians also tried mechanical inhalators from 1908 firstly.

In 1960, Kouwenhoven and colleagues demonstrated that blood circulation could be maintained in a patient without heartbeat only by external cardiac massage. Until this time, cardiopulmonary had been treated by performing thoracotomy, followed by direct massage of the heart. At the same time, Peter Safar introduced new resuscitative protocol using a combination of artificial respiration and airway management through mouth-to-mouth respiration as a complementary medical intervention to external chest massage and defibrillation for maintaining oxygenated blood supply for restoring the patients with cardiopulmonary arrest. Two years later, in 1962, defibrillation was introduced and the American Heart Association proposed the term of cardiopulmonary resuscitation and in 1966 published the first guideline for CPR.

CPR from the time of innovation has enjoyed considerable attention and evolution. Today, a numerous of national and international guidelines use to updating the latest development in CPR techniques and procedures such as “The International Liaison Committee on Resuscitation” from 1992, “The American Heart Association” guidelines from 1966, and “European Resuscitation Council” Guidelines for CPR. Generally CPR is divided into two main categories of action. Firstly, Basic Life Support (BLS) that “refers to maintaining airway patency and supporting breathing and the circulation, without the use of equipment other than a protective device.” Nowadays, with more out-of-hospital CPRs the BLS is also include the use of an automated external defibrillator. Because of low risk of BLS for patients, these interventions are recommended even in those situations that the rescuer is not certain about the victim’s arrest. On the other hand Advanced Life Support (ALS) are a set of medical interventions that try to prevent cardiac arrest, treat cardiac arrest, and improve
outcomes of patients who survive after cardiac arrest. ALS that is fundamentally based on principles of BLS\textsuperscript{23}, should always done by competent professionals. \textsuperscript{24}

There are some especial features of CPR that must be seriously considered while studying ethical aspects of this medical intervention. Firstly, cardiopulmonary arrest is inevitable for all human beings, since regardless of the underlying cause of death, it is an inseparable step of the death process of dying patients. In addition, a person whose heart and respiration are not working will die in a few minutes and any delay in attempting CPR decreases the chance of resuscitation, so decision-making about attempting or not doing CPR is fully emergent decision that must be made in advance. Finally this reality that CPR only helps a few portion of patients who experience cardiac arrest and in those cases that heart beat and breathing restart, patients may be harmed with serious morbidities and suffering, should be taken into consideration\textsuperscript{25}.

In the case of CPR, most of ethical issues arise in circumstances of not attempting CPR. But attempting CPR also has ethical requirements that have been less discussed, mainly because these ethical problems are not as sensitive as not attempting resuscitation. In this paper we will try to discuss these issues. But before that there are some very important points that should be reviewed to clarify the main subject, so we firstly start with a brief explanation of CPR statistics, outcomes, complications, morbidities and also public and professional perceptions about the subject.

**CPR Morbidities and Complications**

As we described above, CPR could possibly involve a wide range of interventions that are performed in order to provide adequate oxygenated blood to the patient’s body especially vital organs and particularly brain during the time of cardiac arrest and also in order to returning the spontaneous heart beat to the patients. The range of medical interventions during CPR starts from simple close-chest cardiac massage (chest compression) or mouth-to-mouth ventilation. In most cases an electrical shock through a defibrillator device is used for defibrillation in both in-hospital and out-of-hospital settings. During ALS the patients are mostly intubated by use of an endo-tracheal tube in order to better oxygenation and more effective ventilation, sometimes using a ventilator. During the ALS the patient is under heart monitoring and electrocardiogram EKG leads are connected to the patient’s body. Some bloodlines are also inserted to the peripheral and central blood vessels, and even heart, for administration of various medications or vital fluids. In some extreme cases of traumatic patients open-chest heart massage may be applied. The use of more complicated devices such as pacemakers, extra-corporal oxygenation devices and aortic pumps is also possible.

As mentioned above, based on the most recent internationally accepted guidelines chest compression with the rate of 100–120 compressions/minute and a depth of 5–6 cm is the most important intervention in the chain of survival during CPR in both in-hospital and out-hospital settings by both lay and professional rescuers. Rib and sternum fracture in one of the most common morbidities of these patients, mainly old and female ones. Some studies reported up to 83% of rib fracture in some hospitals after CPR, especially those performed by non-physician rescuers\textsuperscript{26}. Other previous studies demonstrated 13–97% for rib fracture and 1–43% for sternal fracture during
CPR. Although these chest injuries that are the most common complication of CPR usually heal spontaneously, but in some cases these fractures need surgical intervention therapies. Congestive hemorrhages of the face and brain such as retinal and subarachnoid hemorrhages, cardiac injuries as cardiac rupture, epicardial petechiae, myocardial hemorrhages, and air invasion into the ventricles and abdominal organ injuries such as injuries of the liver and spleen have been rarely reported as a result of chest compression. In addition cases of injuries to the large thoracic vessels, mainly aorta, which is frequently a lethal injury, has been reported. Injuries to the trachea and lungs such as lung rupture because of direct chest compression or stabbing by borders of broken ribs during, collapsed lungs, pneumothorax and subcutaneous emphysema are among these injuries and complications.

**Perceptions about CPR**

End-of-life decision-makings in medical settings are affected by a various series of factors including personal beliefs and previous experiences and discussions with clergy, friends, family and healthcare professionals. One of the most important issues that influence the professional and lay decisions regarding various medical interventions is their perception about the process and outcomes of such treatments. The issue of perception receives more credit when we talk about sensitive medical interventions that usually are performed at the borders of life. In both professional-oriented (paternalistic) and patient-oriented setting the decision-makers’ perception regarding CPR would seriously affect the final decisions. This perception is normally based on the information that people receive about CPR. Thus, having real perception regarding this medical intervention is dependent to having accurate information for both patients and professionals. For patients and their relatives and surrogate decision-makers this true and realistic information is necessary for having informed discussions with involved physicians and other members of medical team. This understanding should be based on realistic awareness of potential benefits and harms of such procedures and likelihood of success.

Some investigations demonstrated that the public lay population usually lacks a realistic and enough knowledge regarding CPR outcomes and their estimation is often much more than the real proved outcomes of this medical intervention. Some studies showed that how misconceptions and wrong optimistic opinions regarding survival outcomes of inpatient CPR affect do-not-resuscitate orders. Most of these studies also emphasized that giving accurate and correct information to the patients and their family at the admission could be helpful for their understanding of the real outcomes, procedure, benefits and risks of CPR and would affect their decisions regarding doing or not-doing. It has been clarified in other studies that if patients truly understand the real chance of success their requests for attempting CPR would noticeably decrease.

The source of information for the public about CPR could be different. Ideally this information should be given to the patients by medical professionals and institutions as hospitals as current resuscitation guidelines recommend, mainly because this kind of information are more reliable and rooted in scientific sources. Nowadays many hospitals now use patient education leaflets that have been found to be acceptable sources to patients and not caused distress and misleading to them. But
these kind of professionally-designed documents are the last information that usually people receive about CPR on their admission at a clinic or hospital, when their perception has been formed by other more public media as television, newspapers and Internet\textsuperscript{44,45}. Some studies demonstrated that perceptions of lay people usually are based on their information that is obtained from media\textsuperscript{46,47,48}.

There are some concerns regarding the role of media in forming the public attitude toward CPR. First of all, naturally television films or movies usually show the immediate result of the CPR process and rarely notice to long term outcomes and as a result the fact that a significant percentage of those who survive the immediate CPR will not survive to be discharged from hospital. Furthermore, this lack of enough concentration on long term issues will lead to disabling these media programs to demonstrate the potential influences and consequences such as hypoxic brain damage on those who survive after CPR and are discharged at these process is usually portrayed as either full recovery or death. Finally these public media programs usually do not match epidemiologic, scientific and demographic realities. Despite of these concerns, some studies claimed that the role of television in public overestimation of CPR outcomes is not because of higher success rates in television fictions but is more a psychological effect. They base their recent claim on some psychological researches in which it is proved that that people ignore base rate statistics information in comparison with dramatic examples. As a result, focusing on some extreme examples of successful CPR in the television shows is more important\textsuperscript{49}.

Performing CPR is a source of stress not only for patients and their families but also is a stressful situation for medical professionals\textsuperscript{50}. However, in contemporary biomedical ethics the authoritative source for goals and values are patients, they usually lack enough knowledge to make decisions on their own and are usually dependent to the medical team. On the other hand in this ethical paradigm, physicians are usually encouraged to promote mutual discussion with their patients and help them to make informed and voluntary decisions especially in such sensitive situations like end-of-life care and withholding treatments including CPR\textsuperscript{51}. In the mutual relationship between patient and physician it is usually assumed that the treating doctor who had accepted the professional role of a healer has sufficient knowledge regarding different medical aspects of the disease including probable outcomes\textsuperscript{52}. As a result lack of sufficient and accurate knowledge by the physicians can potentially influence the patients’ perception about CPR and at the same time the doctors’ decisions. Despite of these facts, some researchers reported that physicians also overestimate patients’ survival rate after undergoing CPR\textsuperscript{53}. More specifically one report demonstrates that the perception of residents of internal medicine is more optimistically in 2005 in comparison to 1995\textsuperscript{54}.

Medical Outcomes & Financial Statistics of CPR

The incidence of CPR for patients with out-of-hospital cardiac arrest considered being 55 in Asia (per year per 100 000 population) \textsuperscript{86} in Europe, 94 in North America and113 in Australia\textsuperscript{55} Recent data in 2010 estimated the global incidence of adult out-of-hospital cardiac arrest about 96 cases per 100 000 person in each year\textsuperscript{56}. In one study the initial success rate
for resuscitation from 1973 to 1977 was 33% for all patients. At the same time, one prospective study showed 4.9% long-term survival rate of resuscitation after cardiac arrest in 1976. Later in 1981 some reports showed less successful results for resuscitation of only 3% in general hospital population. In one meta-analysis, the range of survival rates to hospital discharge up to 1992 was between 6.6% and 24.3%. Diem and colleagues reported survival to hospital discharge survival rates of 6.5%-15% for in-hospital cardiac arrest in 1996. One study shows that the average survival rate to hospital discharge reported in various studies was 13% to the end of 1997. Several studies showed lower survival rates for nursing home residents and unwitnessed cardiac arrests out of the hospitals. Peberdy and colleagues in 2007 retrospectively reviewed a large number of (86,748) adult from 2000, until 2007 and reported survival to discharge rates as 14.7% during the night versus 19.8% during the day/evening. In 2008 Tribble in his review reported that survival to hospital discharge is around 15% and rarely more than 20%.

A recent meta-analysis about in-hospital resuscitation estimated that from 1985 to 2010, average rate of survival to discharge was 17.5% and founded a trend towards increasing survival in more recent studies.

Calculation of financial burdens of CPR on the health system and families could be done by two methods. In the first method, only the direct costs of in-hospital CPR intervention and its related treatments including human resources (medical and nursing staff), medications, instruments and accessories, transportation and short period of hospitalization during CPR could be calculated. If we ignore the rare cases with expensive CPR interventions using pacemakers, aortic pumps or extracorporeal blood oxygenation techniques, routine BLS and ALS involves a ordinary cost like many other ordinary treatments. But without considering the financial consequences of the CPR treatment, this method of calculation could be misleading. In a more sophisticated calculations those financial measures such as the training costs of the involved medical professionals and administrators, the costs of the institution equipment and maintenance system and governmental subsidies should be taken into consideration. In addition to above factors, for out-of-hospital setting of CPR interventions the costs of training public and non-medical professional (like Firemen and EMS personnel) and national-wide or regional full-time (24 hours, 7 days) emergency medical systems for CPR delivery should also be considered. Because of involvement various factors, attributing a cost to out-of-hospital CPR is much more complicated than in-hospital settings.

For a second and more convincing cost measurement, factors such as short-term post-CPR outcomes and prognosis, such as the survival rates to hospital discharge and long term factors as the quality of life and productivity of those survivors who survive to discharge from the hospital and their long term survival should be taken into consideration. Through this method all the CPR expenses are calculated to address the cost of saving one life. For example, the estimation of one study in 1992 for each CPR survivor was 60,327 USD and the total cost for the CPR program of targeted hospital within the 21-month period, included training, equipment, human resources, maintenance costs, the daily hospitalization costs for survivors, was estimated 2,352,771 USD. In 1994 a survey demonstrated that the cost estimation of CPR per quality-adjusted life years...
was 61,000 USD, while the estimated cost with the cost of treating low-birth weight newborns in an ICU per quality-adjusted life years that was $8000 at the same year\(^7\). Finally, one study in 1996 used and adjusted previous studies data and showed that the estimated cost of CPR programs for all 6-month survivors of a large international multicenter collaborative trial were 406,605 USD for each saved life and 225,892 USD per quality-adjusted-life-year\(^7\). In one retrospective study in 2002, 63% of 256 cancer patients who underwent CPR in ICU during an eight-year period died at the time of the arrest. From other 150 patients (37%) who survive the first arrest, 104 patients (26%) died before discharge. For this late group the mean ICU charges from the date of CPR to the date of death were $45,877\(^7\).

The reason of such high costs of CPR in United States is usually its nature of being done mostly on patients who are in critical health situations. As a result, most of the survivors would stay at critical care units and receive ICU care, which is very costly and expensive health service. Recent statistics show that more than 100 billion USD (20 % of total health care expenditure) was spent on critical care in the United States in 2010.\(^7\) These costs are from a country that has implemented organized programs and guidelines for the do-not-resuscitate orders from 1980s as well as well-designed advance directives that improve the quality of end-of-life care and reduce financial burdens on the families of terminally ill patients\(^7\). Thus, despite lack of enough, even any, data from those countries that CPR is yet practiced as a default medical intervention, it would not very hard to conclude that the portion of CPR programs costs of total health care expenditure in those countries is higher than United States. In other word, CPR, is relatively more costly for health systems of countries without DNR programs.

**Ethical Considerations of CPR**

The four-principle approach is the most famous ethical framework for contemporary modern medical ethics. CPR is not an exception and the most important international guidelines use the same set of principles as their ethical underpinnings. Four key principles for this intervention are usually referred to as autonomy, beneficence, non-maleficence, and justice. The principle of respect for autonomy requires the person’s ability to decide free from the control of others and with sufficient level of understanding as to provide for meaningful choice. To be autonomous requires a person to have the capacity to deliberate a course of action, and to put that plan into action\(^7\). In medical setting, respecting autonomy requires respecting the right of the patient to accept or refuse different types of treatment rather than being imposed by paternalistic decisions of medical professionals. Logically the patient should be able to make informed decisions or in more technical word should be “competent” to give informed consent. This principle seems to be a newly inserted principle into ethics of medical practices, mainly in second half of the twentieth century. The principles of non-maleficence which means doing no harm and beneficence which implies that healthcare providers must attempt in the best interest of the individual patient enjoy more historical background in the field of medical practice from the ancient time and are mentioned in Hippocratic Oath. The last principle from this series is justice, which usually used as a principle for fair justified distribution of scarce health resources in the society\(^7\).
Although the principle of autonomy seems to be universally accepted, but its application in emergency situations such as cardiopulmonary arrest is disputed and difficult. The three main steps for achieving an informed and voluntary decision in an appropriate atmosphere of patient-professional relationship are firstly receiving and understanding accurate information about the medical situation by the patient (including the disease or intervention prognosis, nature, alternatives, risks and benefits), secondly assuring of correct understanding and finally the patients’ opportunity for choosing and justifying the desired alternative. But for the emergency interventions such as CPR, going through these three steps is not possible because of the nature of cardiopulmonary arrest in which the patient is not conscious, and thus competent, for giving consent after passing these three steps. It seems to be a universal consensus for such emergency situations, in absence of possibility for obtaining an informed consent because of reasons such as impaired competency and lack of information about the patient’s preferences, that the medical interventions for treating emergency condition should be started immediately until further information is available. In the absence of a patient’s previous will or advance directive for not attempting CPR, the idea of presumed consent is accepted. The acceptability of attempting resuscitation without searching for patients’ consent is intuitionally and easily understood. The especial characteristics of cardiopulmonary arrest like dying person within a very few minutes in absence of heartbeat or irrecoverable and great reeducation of the efficacy of the effort by any delay in resuscitation provide sufficient arguments for attempting resuscitation when the patient is incapable of communicating his or her wishes. The application of the principle of non-maleficence for performing or not performing CPR is usually in those cases that the CPR seems to be medically futile. Beneficence may be more interpreted to support the choice of attempting resuscitation, but it could be also interpreted in a way that requires not attempting CPR. The implication of justice in the case of CPR intervention implies the need for fair distribution of available health resources to provide resuscitation for all who need this medical intervention.

Potential Harms and Dangers for Rescuers and CPR Team:
Transmission of infection between the patient and rescuer is one of the potential hazards that may affect the rescuers while performing CPR, especially moth-to-mouth ventilation. Unwillingness for attempting moth-to-mouth ventilation by lay citizens and emergency and medical professionals has been documented in several studies. The main reason for such reluctance was the fear of transmissible diseases such as Tuberculosis and AIDS. Few studies have reported transmission of different infectious diseases during mouth-to-mouth resuscitation: Salmonella, Herpes simplex, Helicobacter pylori, severe acute respiratory syndrome Coronavirus and more recently Staphylococcus aureus. Although the risk of transmission of HIV is negligible, a study in 1996 demonstrated that the patients were discriminated regarding receiving mouth-to-mouth ventilation based their risk for being HIV positive and those patients perceived to be at high risk for HIV were less likely to receive this treatment than those at low risk. But one systematic review demonstrated that in the absence of high-risk cutaneous exposures, such as intravenous cannulation, there were no reports of transmission of hepatitis or HIV during training or actual CPR.
For medical professionals it may be possible to apply protective safeguards in some situations but in absence of such equipment the question would remain open. It may be argued that saving a life usually outweighs the chance of being infected while performing CPR, especially when victims are considered to be at low risk of contamination by infectious diseases. The risk of being infected may play a central role in performing such procedures by related professionals including firemen, emergency team members, nurses or physicians. But this risk is not always such low to be negligible. In situations such as epidemics of dangerous diseases, for those patients that because of trauma suffer from bleeding in mouth cavity or for those with other fluids due to vomiting, answering the question is not probably very easy. From an ethical point of view in the context of professional ethics, it would be important to define whether performing mouth-to-mouth ventilation is a moral duty of medical professional or it is a “Supererogatory Act”. However, our response to this question cannot solve moral dilemmas of medical professionals who encounter such situations and also may be is not enough to dissolve the “Moral Residue” of not performing complete CPR for any patient.

Other ways of transmission of infectious diseases from patients to medical professionals are also possible during CPR process, for example though needling. These problems seem to be routine results of contacting with patients in a clinical setting, but need more attention in an emergency situation, mainly because CPR is naturally an emergency. In addition other physical and psychological harms are reported to be very low and negligible. The most fears are usually related to the use of public defibrillation devices but one large randomized trial showed that this intervention could be safe for lay people and first rescuers. Due to general moral commitments regarding helping needy people, for lay people who may perform this kind of out-of-hospital resuscitation same concerns and moral dilemmas may emerge. Although the probability of doing mouth-to-mouth ventilation for lay person is pretty low and in most of the cases, they attempt this resuscitative effort on their relatives or friends, it could be a source of concern mainly in epidemics of infectious diseases. In such situation the role of health policy makers could be discussed from an ethical point of view.

**Presence of family members or close relatives during resuscitation**

The questions about the fairness of a policy to exclude close relatives from the emergency room during attempted resuscitation, raised in 1982, after a survey that demonstrated relatives and family members would like to be present during the resuscitation process. The study led to a change in policy and responding to this reasonable wish, some selected family members was allowed to present at the time of resuscitation and interestingly none of the present relatives interrupted or interfered with resuscitation efforts. Other studies also showed the desire of family members, even parents, to be present at the patients' bedside during resuscitation including those who experienced this situation before. Parental presence is accepted in many western societies and does not seem to be disruptive or causing stress for the medical professionals who performing CPR for the children. Presence of parents during CPR also may lead to better maintenance of healthcare providers' behavior and also giving them a better provision and understanding of a child or infant as a human being and a family member.
Despite of emphasis and recommendation of international guidelines regarding premising family presence during CPR, allowing family members to be present remains a matter of debate in many countries and the issue does not enjoy a universal consensus from the medical professionals' points of view. Although in some studies in Asian countries recently showed that medical team members support the presence of family member during resuscitation, but one study from Saudi Arabia in 2012 demonstrated lack of a clear policy about this issue in that country and showed nurses opposition to the presence of family members during CPR. Majority of Saudi nurses in this study also denied the right of families to request being witnesses of CPR in emergency room. Similarly one study from Iran demonstrated lack of a clear policy and also opposition of majority hospital staff (77%) toward family-witnessed resuscitation. The most common reasons for their opposition were fear of psychological trauma to family members, possible interference with patient care and CPR team decision-making, and also imposing stress on the CPR team members. Based on this study, opponents of family-witnessed resuscitation arguments include disturbance of patient care, increasing liability and staff stress, the probability of compromise patient confidentiality and causing psychological trauma to family members.

Proponents emphasize that presence of family members paves the way for easier acceptance of death for them and reduces their reaction. And also help them to understand that all reasonable and possible intervention have been performed during the process of resuscitation which might led to decreasing the risk of legal complaints and also facilitates forming a better relationship between medical team and the patient's family. In 2005, “The Guidelines for Resuscitation of European Resuscitation Council” demonstrated a list of benefits that patients' family would enjoy benefits from being allowed to be present during a resuscitation procedure, including: better realization of death, easing the bereavement process, being in more close contact with the loved dying person in the final moments, feeling present and supporting to their patient, feeling that they had been witness to see that every possible and reasonable thing that could be done, was done. For ensuring better experience of those patients' relatives who witness the CPR process, this guideline introduced some measures including open and welcoming attitude to relatives, briefing the relatives and making them aware of the procedures and the patient's response (e.g., convulsive movements after defibrillation) and emphasizing on the importance of not interfering with any procedures and finally acceptable responsiveness to the relatives in cases such as abandoning the CPR and other questions that they might have. The 2010 guideline of this organization also again emphasized on the same point of view and supported the presence of the family members in the time of CPR in both in-hospital and out-hospital settings. This document also claims that with increasing experience of family-witnessed CPR, it has being cleared that problems rarely arise. The attitudes have been also changed from 1990s, when most staff would not agree the presence of relatives during resuscitation, but there is an increasingly open attitude toward this issue mainly because of more appreciation of patients' and their relatives' autonomy. Finally this new version accepts cultural and social variations that exist around the presence of family members during CPR and emphasizes on importance of good
understanding of these differences and sensitivities.\textsuperscript{102}

Finally it could be claimed that today presence of family during CPR is an accepted issue that enjoys a relative consensus in Western countries and usually is seen as a “Right” of family members that could not be violated by institutional policies or regulations, the idea that improves the relationship between families and medical team\textsuperscript{103}. It seems that from an ethical point of view, it could not easily justifiable to foreclose the right of family for being present during CPR, unless there are sufficient arguments that prove that it is not in favor of the patient or may affect the CPR process in a negative way. Nowadays there is growing tendency in United States to allow presence of family members during resuscitation, even in operating room\textsuperscript{104}. This practice also is enjoying acceptance among European countries. The emotional support for family members and close relatives should be continued after unsuccessful CPR process. It is more important when the death happens after a sudden cardiac arrest following by an unsuccessful CPR. In such situations the survivors are not prepared for losing close relatives. For better handling of delivering bad news to survivors it is important for those medical professionals who are the responsible people for breaking bad news to (usually physicians) are required to learn effective techniques for breaking bad news using nonmedical language\textsuperscript{105}.

\textbf{Research and Training in CPR}

Like any other medical practice, improving the science and technology in order to development CPR requires well-organized research and trials that usually should be done on human subjects and in clinical setting. The issue of research about CPR seems to be more important to develop new and more efficient methods and instruments and decrease the use of inefficient and very expensive procedures\textsuperscript{106}. The importance of such researches is clearer when there is a universal consensus on more traditional based of contemporary CPR interventions than scientific\textsuperscript{107}. Since the time of Nuremberg declaration in 1947, condition of research on human subjects and performing clinical trial has been dramatically improved to protect the human subjects’ dignity through respecting their informed and voluntary decisions using the language of “respecting people’s autonomy”, reflected in many ethical and legal national and international documents\textsuperscript{108}. These regulations had been put barriers for knowledge improvement in field like CPR when routine criteria for research could not been easily met and have had negative effects on research progress in resuscitation\textsuperscript{109}.

Therefore, on one hand, CPR research is unavoidable, and on the other hand, because of the nature of cardiac arrest that takes place in a very complicated situation when the patient is unconscious and a very short time is usually left for performing CPR and saving the patients’ life, it would be very difficult meet all required criteria for medical research in such situation, especially to obtain informed consent\textsuperscript{110}. In order to achieving a relative solution for the consent problem for doing research in situations such as CPR some exceptions has been introduced to facilitate those researches that the human subject of research’s life is threatened by a life-threatening or permanently disabling situation, the only known medical intervention for saving the subject’s life is investigational therapy, obtaining consent from surrogate decision maker is not possible, the intervention is likely to have direct benefit to the research subject , and there is no better ac-
cepted therapy and finally the research protocol is approved by an ethics research committee. Despite of these exceptions, problems and difficulties still remained in the field of research in CPR.

The similar problems and disagreements are present when speaking about research and training on newly dead patients just after CPR. The issue of consent is again the major problem in this regard. There are evidences that shows asking for consent from recently deceased's family or closed relatives in order to doing research or training purposes may result in uncomfornted and even angry responses. A recommended solution for increasing the chance of such research or training activities is the use of preauthorization program through incorporating such issues in living wills and advance directives. It is recommended that using a structured, multidisciplinary approach in the situation of sudden death in emergency department by sensitized and educated staff can be helpful and would result in better emotional support for the survivors. Although some protocols for breaking bad news has been introduced but their use in the situation of sudden death should be revised and adjusted.

**Conclusion**

Although the most debated ethical issue of CPR is related to DNR orders, CPR has other ethical dimensions. Our review demonstrated that making decisions about CPR is usually affected by issues such as overestimating CPR outcomes, ignoring indirect financial burdens of CPR on patients and health system and neglecting potential harms and complications caused by CPR. In addition we concluded the risks of CPR for the rescuers are usually low that could be ignored. We also argued that in addition to medical professionals, attempting CPR today is a public moral responsibility. Finally, presence of family during CPR process enjoys a full ethical support and should be promoted in clinical settings.

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