Guidelines: Prevention of cardiac arrest and decisions about CPR

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1. The guideline process

The process used to produce the Resuscitation Council UK Guidelines 2015 has been accredited by the National Institute for Health and Care Excellence. The guidelines process includes:

• Systematic reviews with grading of the quality of evidence and strength of recommendations. This led to the 2015 International Liaison Committee on Resuscitation (ILCOR) Consensus on Cardiopulmonary Resuscitation and Emergency Cardiovascular Care Science with Treatment Recommendations. 1,2
• The involvement of stakeholders from around the world including members of the public and cardiac arrest survivors.
• Details of the guidelines development process can be found in the Resuscitation Council UK Guidelines Development Process Manual.
• These Resuscitation Council UK Guidelines have been peer reviewed by the Executive Committee of Resuscitation Council UK, which comprises 25 individuals and includes lay representation and representation of the key stakeholder groups.

2. Introduction

Prevention of cardiac arrest is the first link in the Chain of Survival.3 This section of the Resuscitation Council UK guidelines stresses the importance of preventing cardiac arrest in all age groups, and the decision-making process when
cardiopulmonary resuscitation (CPR) is inappropriate. This update is based on the European Resuscitation Council Guidelines 2015, and includes updates based on NICE Clinical Guideline 50, and the guidance from the British Medical Association (BMA), Resuscitation Council UK, and the Royal College of Nursing (RCN) on decisions relating to CPR. The General Medical Council publication, ‘Treatment and care towards the end of life: good practice in decision making’, also includes advice on decisions relating to CPR.

3. Prevention of out-of-hospital cardiac arrest

Recognising and responding to cardiac chest pain

Most sudden cardiac death (SCD) victims have a history of heart disease and warning symptoms, most commonly chest pain, in the hour before cardiac arrest. Early recognition of cardiac chest pain and rapid activation of the EMS is vitally important. When a call to the EMS is made before a cardiac arrest victim collapses, the ambulance arrives significantly sooner after collapse, and the chance of survival is higher. Prompt assessment of people with acute chest pain by the EMS, including recording and interpretation of a 12-lead ECG, enables appropriate treatment of acute coronary syndromes with a minimum of delay (especially reperfusion therapy, usually by primary percutaneous coronary intervention [PPCI] for ST-segment myocardial infarction [STEMI]), reducing the risk of early cardiac arrest and death and of subsequent complications, including death.

Recognising and responding to other causes of cardiac arrest and sudden death

Coronary artery disease is the commonest cause of SCD in people over the age of 35 years. Other causes of SCD include cardiomyopathies, valve disease, inherited ion channel disorders (e.g. long and short QT syndromes, Brugada syndrome, catecholaminergic polymorphic ventricular tachycardia) and congenital heart disease. Whilst cardiac arrest and SCD are relatively uncommon in people younger than 35, coronary disease is also less common in this age group, so an inherited condition is more likely to be the cause when a younger person suffers unexpected cardiac arrest or SCD.

In patients known to have heart disease, syncope (with or without prodrome –
particularly recent or recurrent) is an independent risk factor for increased risk of death.8 Apparently healthy children and young adults who suffer SCD may also have symptoms and signs (e.g. syncope/pre-syncope, chest pain, palpitation, heart murmur) that should alert healthcare professionals to seek expert help to prevent cardiac arrest in those at risk. Features that indicate a high probability of arrhythmic syncope (and potential risk of SCD) include:

- syncope in the supine position
- syncope occurring during or after exercise (although syncope after exercise is often vasovagal)
- syncope with no or only brief prodromal symptoms
- repeated episodes of unexplained syncope
- syncope in individuals with a family history of sudden death or inherited cardiac condition.

Assessment in a clinic specialising in the care of those at risk of SCD is recommended in family members of young victims of SCD or those with a cardiac disorder resulting in an increased risk of SCD.16 Specific and detailed guidance on the care of individuals with transient loss of consciousness is available from the National Institute for Health and Clinical Excellence (NICE).17

4. Prevention of in-hospital cardiorespiratory arrest

Rates of survival and complete physiological recovery following in-hospital cardiac arrest are poor in all age groups. For example, fewer than 20% of adult patients having an in-hospital cardiac arrest (IHCA) will survive to go home.18 Cardiac arrest is rare in both pregnant women and children, but outcomes in these groups after in-hospital arrest are also poor. Prevention of in-hospital cardiac arrest requires staff education, monitoring of patients, recognition of patient deterioration, a system to call for help and an effective response.19

Adults

Most adult survivors of in-hospital cardiac arrest have a witnessed and monitored ventricular fibrillation (VF) arrest and are defibrillated immediately.20 The underlying cause of arrest in this group is usually myocardial ischaemia. In
comparison, cardiac arrest in patients in unmonitored ward areas is usually a predictable event not caused by heart disease.\textsuperscript{21} In this group, cardiac arrest often follows a period of slow and progressive physiological deterioration involving unrecognised or inadequately treated hypoxaemia and hypotension.\textsuperscript{22} The cardiac arrest rhythm is usually asystole or PEA, and the chance of survival to hospital discharge is extremely poor unless a reversible cause is identified and treated immediately.

Regular monitoring and early, effective treatment of seriously ill patients appear to improve clinical outcomes and prevent some cardiac arrests. However, the quality of monitoring of vital signs may vary and may differ between day and night.\textsuperscript{23} Closer attention to patients who sustain a ‘false’ cardiac arrest (i.e. a cardiac arrest call to a patient who does not require basic or advanced life support) may also improve outcome, as up to one third of these patients die during their hospital stay.\textsuperscript{24} Data from the USA suggest that hospitals with the lowest incidence of IHCA have the highest cardiac arrest survival, suggesting better selection of candidates for CPR or better prevention of cardiac arrest or both.\textsuperscript{25}

**Deficiencies in acute care**

Analysis of the critical events preceding many adult cardiac arrests demonstrates many significant antecedents, usually related to abnormalities of the airway, breathing, and circulation.\textsuperscript{22} Additional factors include a failure to use a systematic approach to the assessment of critically ill patients, poor communication, lack of teamwork, and insufficient use of treatment escalation plans.

Hospital processes may also have significant effects on patient outcome. For example, patients who are transferred from intensive care units (ICUs) to general wards at night have an increased risk of in-hospital death compared with those transferred during the day and those transferred to high-dependency units.\textsuperscript{26} Higher nurse-patient staffing ratios are also associated with lower cardiac arrest rates and lower rates of pneumonia, shock, and death.\textsuperscript{27,28} These suggest that adequate patient monitoring and assessment are crucial to preventing adverse outcomes.

**Recognition of ‘at-risk’, or critically ill, adult patients**

When patients deteriorate, they display common signs that represent failing respiratory, cardiovascular, and nervous systems. This is the basis for monitoring
patients’ vital signs. Abnormal physiology is common on general wards,\textsuperscript{29} yet the important physiological observations of sick patients are measured and recorded less frequently than is desirable.\textsuperscript{23} To assist in the early detection of critical illness, every patient should have a documented plan for vital-signs monitoring that identifies which variables need to be measured and the frequency of measurement.\textsuperscript{30}

In recent years, early warning scores (EWS), or ‘calling-criteria’ have been adopted by many hospitals to assist in the early detection of critical illness.\textsuperscript{31} EWS systems allocate points to routine vital-sign measurements on the basis of their deviation from an arbitrarily agreed ‘normal’ range. The weighted score of one or more vital-sign observations, or more often the total EWS, is used to alert ward staff or critical care outreach teams to the deteriorating condition of the patient. Systems that incorporate ‘calling criteria’ activate a response when one or more routinely measured physiological variables reach a pre-defined abnormal value.

The sensitivity, specificity, and accuracy of EWS or calling-criteria systems to identify sick patients have been validated for several outcomes.\textsuperscript{32-34} Several studies have identified abnormalities of heart rate, blood pressure, respiratory rate, and conscious level as possible markers of impending critical events. The ability of these systems to predict cardiac arrest remains less than for other outcomes such as death or unanticipated ICU admission. In the UK, the National Early Warning Score (NEWS) is recommended.\textsuperscript{35} Gaps in vital-sign data recording are common; the use of EWS, calling criteria and rapid response systems can increase the completeness of vital sign monitoring. Simpler systems may have advantages over more complex ones.\textsuperscript{36,37} EWS may be better discriminators than calling-criteria systems.\textsuperscript{38} Nurse concern may also be an important predictor of patient deterioration.\textsuperscript{39}

**The clinical response**

The medical and nursing response to a patient’s abnormal physiology must be both appropriate and speedy, yet this is not always the case.\textsuperscript{40} Traditionally, the response to cardiac arrest has been reactive, with a cardiac arrest team attending the patient after the cardiac arrest. The use of such teams appears to improve survival in circumstances where no coordinated response to cardiac arrest existed previously. However, their impact in other settings is questionable. For example, in one study only patients who had return of spontaneous circulation (ROSC) before the arrival of the cardiac arrest team survived to leave
In some hospitals the role of the cardiac arrest team has been incorporated into that of the medical emergency team (MET). The MET responds not only to cardiac arrests, but also to patients with acute physiological deterioration. The MET usually comprises medical and nursing staff from intensive care and general medicine and responds to specific calling criteria. MET interventions often involve simple tasks such as starting oxygen therapy and intravenous fluids.

The results of research into the benefits of introducing a MET are variable, although evidence for their benefit is increasing. Studies with historical control groups show a reduction in cardiac arrests, deaths and unanticipated intensive care unit admissions, improved detection of medical errors, treatment-limitation decisions, and reduced postoperative ward deaths. A cluster randomised controlled trial of the MET system was unable to demonstrate a reduction in the incidence of cardiac arrest, unexpected death, or unplanned ICU admission.

In the UK, a system of pre-emptive ward care based predominantly on individual or teams of nurses known as critical care outreach has developed. Although the data on the effects of outreach care are also inconclusive, it has been suggested that outreach teams may reduce ward deaths, postoperative adverse events, ICU admissions and readmissions, and increase survival.

The role of education in cardiac arrest prevention

The recognition that many cardiac arrests may be preventable has led to the development of postgraduate courses specifically designed to prevent physiological deterioration, critical illness, and cardiac arrest (e.g. Acute Life Threatening Events - Recognition and Treatment: ALERT). Early evidence suggests that they can improve knowledge and change attitudes about acute care. The Immediate Life Support (ILS) and Advanced Life Support (ALS) courses also include sections related to arrest prevention. Implementation of the ILS course is associated with a reduced incidence of cardiac arrest. Simulation is being used increasingly to train staff in the prevention of patient deterioration. Rapid response teams, such as METs, have a role in educating and improving acute care skills of ward personnel.

Pregnant patients

Past reports of the triennial Confidential Enquiry into Maternal and Child Health (CEMACH) have made recommendations for preventing deaths associated with
pregnancy, including the need for hospitals to implement, audit, and regularly update multidisciplinary guidelines for the management of women who are at risk of, or who develop, complications in pregnancy. Other recommendations include the development of clinical protocols and local referral pathways, including patient transfer, for pregnant women with pre-existing medical conditions, a history of psychiatric illness, and serious complications of pregnancy (sepsis, pre-eclampsia and eclampsia, obstetric haemorrhage). Maternity teams should be trained to recognise and manage medical emergencies, and to demonstrate their competency in scenario-based training using simulation. CEMACH recommends the routine use of a national modified early obstetric warning score (MEOWS) chart in all pregnant or postpartum women in all hospital settings.\textsuperscript{51} Outreach services for maternity have also been described elsewhere.\textsuperscript{52,53}

**Children**

In children, cardiorespiratory arrest is more often caused by profound hypoxaemia and/or hypotension than by heart disease. Ventricular fibrillation is less common than asystole or pulseless electrical activity. As with adults, there may be opportunities to introduce strategies that will prevent arrest.

There is already evidence of marked, often untreated, abnormalities of common vital signs in the 24 hours prior to the admission of children to an ICU, similar to those reported in adults.\textsuperscript{54} Recognition of the seriously ill child requires determination of the normal and abnormal age-related values for vital signs, and then measuring and reassessing vital signs in the context of the progression of the individual child’s condition. As in adults, serial measurement of heart rate, respiratory rate, temperature, blood pressure, and conscious level, particularly following any clinical intervention, must be performed and acted upon.

Intervention at an early stage in an unwell child reduces significantly the risk of developing irreversible shock. Systemic blood pressure decreases at a late stage in shock in the child compared with the adult, and should not be used as the sole determinant of whether or not treatment is required.

Paediatric METs, responding to early warning scores, have been established in some hospitals, but, as in adult studies, their impact is difficult to measure. However, there is some evidence that they reduce the incidence of deterioration and cardiac arrest.\textsuperscript{55,56}
5. Resuscitation decisions

Please see below:

**Why decisions about CPR are needed**

CPR was originally developed to save the lives of people dying unexpectedly when acute myocardial infarction (AMI) caused sudden cardiac arrest in ventricular fibrillation – ‘hearts too good to die’.\(^{57}\) As awareness of CPR increased and resuscitation equipment became more widely available and more portable, attempts at CPR became very common in situations other than a sudden cardiac arrest due to AMI. When a person dies, the heartbeat and breathing cease, so the distinction between cardiorespiratory arrest that is sudden and unexpected and cardiorespiratory arrest that occurs in the context of death from an advanced and irreversible cause is not always made. As a result CPR has been attempted commonly in people who are gravely ill, and for whom attempts to restart their heart either would not work (subjecting them to violent physical treatment at the end of their life and depriving them of a dignified death) or might restore their heart function for a brief period and possibly subject them to a further period of suffering from their underlying terminal illness (prolonging the dying process without prolonging life). A study by the National Confidential Enquiry into Patient Outcome and Death found that CPR was attempted in hospitals in many people for whom there was little or no likelihood of benefit, yet no anticipatory decision had been considered or made about CPR.\(^{58}\)

The need for anticipatory decisions arises because those present at the time of death or cardiac arrest must make an immediate decision whether or not to start CPR. Any delay will reduce the chance of success in those for whom CPR may be beneficial, as emphasised elsewhere in these guidelines. As those present may not know or have instant access to full details of the patient’s circumstances there is a presumption that CPR will be attempted when someone suffers cardiorespiratory arrest or dies, unless there is a clearly recorded decision not to do so. Many healthcare provider organisations have a policy requiring their staff to attempt CPR in such circumstances.

**When to consider making decisions about CPR**
Recognition of an ‘at-risk’ or critically ill/deteriorating patient should trigger consideration of whether or not attempted CPR would be successful and/or in the patient’s best interests. Critical care outreach and medical emergency teams may contribute to a ‘reduction’ in cardiorespiratory arrests by triggering such consideration and thereby avoiding inappropriate CPR attempts.\textsuperscript{59-65} However, a crisis situation when someone is acutely unwell and has been admitted to hospital, is not the optimal time to make anticipatory decisions about CPR for most people who have advanced medical conditions and are approaching the end of life. Early consideration of CPR decisions is recommended in the context of broader ‘advance care planning’ (see ‘Discussing decisions about CPR’ below).

**Situations where a decision about CPR should be considered**

Decisions about CPR should be considered, discussed and recorded:

- At the request of a person with capacity.
- As an important element of end-of-life care for a person who is terminally ill from an advanced and irreversible disease.
- As an important element of care of a patient with an acute severe illness, who continues to deteriorate towards death despite all appropriate treatment or who has suffered a sudden catastrophic event from which no recovery can be reasonably expected.
- As an element of care of people recognised by healthcare professionals as approaching the end of their lives (i.e. within the last year of life).

**Making lawful decisions about CPR**

Healthcare professionals must follow a good decision-making process that complies with all relevant legislation, including laws relating to capacity, discrimination and human rights.\textsuperscript{6,66-69} A report of a confidential inquiry into premature deaths of people with learning disabilities found evidence of poor compliance with capacity legislation and poor adherence to guidance on CPR decision-making, resulting in decisions that appeared to discriminate against people with learning disabilities.\textsuperscript{70} The courts have stated that there should be a presumption that the patient will be involved in decisions about CPR unless discussions about CPR would cause the patient physical or psychological harm. When a do-not-attempt-cardiopulmonary resuscitation (DNACPR) decision is made by clinicians because CPR would not be successful, it is expected that the
patient would have the decision and the reasons for it explained to them. Patients and those close to them cannot demand treatment that is clinically inappropriate. However, clinicians must not make judgements about a person’s quality of life based on their own perceptions of what would be acceptable. Where there is some chance that CPR may be successful the aim should be to provide the patient and those close to them with information to enable their participation with their healthcare team in a shared decision about whether or not CPR will be attempted, and in what circumstances.

Some patients will have the capacity to participate in the decision-making process, but a substantial number will not. When a person does not have capacity to participate in the decision-making process it is the responsibility of the senior responsible clinician to make decisions about CPR, unless the patient has recorded their wishes in an Advance Decision to Refuse Treatment or has a representative with legal authority (e.g. Power of Attorney) to make such decisions on the patient’s behalf. Where there is a chance that CPR may be successful in restarting the heart and breathing for a sustained period any decision must be made in the patient’s best interests. Whenever possible this should take into account the views of the patient’s family or others close to the patient. Care should be taken to ensure that they understand that they are not being asked to make the decision and (unless they have been given specific legal authority) have no power to make the decision; their role is to help the senior clinician to make the best decision.

**Discussing decisions about CPR**

Both patients and healthcare professionals find discussions and decisions that focus purely on withholding CPR difficult. They prefer an approach that considers whether or not CPR would be appropriate for the individual person, and contextualises that decision within a broader plan of the person’s wishes regarding other elements of their care and treatment.\(^{71}\)

When possible, this is often best done in the person’s usual home setting, involving one or more healthcare professionals who know the patient well. Discussions about CPR should be undertaken by professionals who have the knowledge and communication skills to support the patient in making an informed decision. Discussions should be supported where possible by information in written or other formats.
Some patients with capacity will choose to discuss and engage in decisions about their end-of-life care whilst others will choose not to do so, and such wishes should be respected.

**Recording decisions about CPR**

All considerations, discussions and decisions about CPR must be recorded fully and clearly, together with details of the reasons for any decision. Such decisions should also be communicated clearly, where necessary in writing, to all those involved in the patient’s care. It is recommended that decisions about CPR (and about other elements of emergency care and treatment) are recorded on a standard form that crosses geographical and organisational boundaries and is recognised/accepted by all organisations and individuals involved in a person’s care. Such a form should remain close to the patient at all times and be kept in a place where it will be accessible immediately by anyone needing to refer to it in an emergency. Where electronic records are used to generate and store documented decisions about CPR the systems used must be accessible immediately by all those who may need to see the records, must be secure and must be responsive to any reversal of the recorded decision.

**Reviewing decisions about CPR**

Just as every hospital patient should have a plan detailing their individual needs for type and frequency of vital-sign measurement, so every person with a CPR decision should have a recorded plan detailing their individual need for review of that decision. For a person with an advanced, irreversible condition who is close to the end of their life there may be no need for review of a DNACPR decision. In contrast, when a person is being treated for a severe, acute, life-threatening illness a decision to attempt CPR in the event of cardiac arrest should be reviewed frequently and may warrant changing if they deteriorate or fail to respond to treatment. Similarly a DNACPR decision, made when they are critically ill and highly unlikely to survive cardiac arrest, should be reconsidered frequently so that it can be reversed if appropriate should they respond to treatment and may benefit from and wish to have CPR in the event of cardiac arrest.

Recorded decisions about CPR should be reviewed:

- if the patient requests review
• if those close to the patient request review
• whenever there is a significant change in the patient’s clinical condition
• when the patient moves from one care setting to another (including transfer between wards or teams in a hospital).

Applying decisions about CPR

A recorded decision not to undertake CPR refers only to CPR and not to any other element of a person’s care and treatment. There is evidence of substantial misunderstanding of this by healthcare professionals and by the public. Health professionals must ensure that a DNACPR decision does not compromise any other aspect of a patient’s care and treatment.

Decisions about CPR for children and young people

The ethical principles that underpin decisions about CPR for children and young people are no different from those in adults. Whenever possible, decisions should be made within a supportive partnership that includes patients, parents and healthcare professionals. As with adults, it may be best to make such decisions in the context of a broader decision-making framework. The degree of involvement of the patient varies, as the ability of a child or young person to engage with and contribute to the decision-making process may change quite rapidly. Involvement of those with parental responsibility is usually crucial, but can present difficulties if a child or young person does not want parental involvement, or if the parental view differs from the wishes of the child or young person themselves. Detailed guidance on making decisions to limit treatment in children has been published by the Royal College of Paediatrics and Child Health.

Policies and clinical audit of CPR decision

Each hospital should have a policy on CPR decisions, based on current national guidance. Each hospital should undertake on-going clinical audit of adherence to that policy and of the standards achieved with both consideration and recording of decisions about CPR. All hospitals should participate in the National Cardiac Arrest Audit.
6. **Recommended strategies for the prevention of avoidable cardiac arrests and inappropriate CPR attempts**

1. Ensure that people with symptoms suggestive of acute coronary syndromes are assessed and treated appropriately without delay.
2. In particular ensure that people with STEMI receive reperfusion therapy without delay, wherever possible by timely primary percutaneous coronary intervention (PPCI).
3. Ensure that people with symptoms that may indicate a risk of cardiac arrest and SCD (e.g. unexplained syncope) receive prompt assessment that includes a 12-lead ECG and, where appropriate, are referred for prompt assessment by a heart rhythm specialist.
4. Ensure that people with conditions that may indicate a risk of cardiac arrest and SCD (e.g. complete heart block, severe left ventricular impairment, severe aortic stenosis, hypertrophic cardiomyopathy) receive prompt specialist assessment and appropriate treatment.
5. In hospitals, place critically ill patients and those at risk of rapid deterioration in areas where the level of care is matched to the seriousness of each patient’s condition.
6. Monitor such patients regularly using simple vital-sign observations (e.g. pulse and/or heart rate, blood pressure, respiratory rate, conscious level, temperature and SpO2).
7. Match the frequency and type of observations to the severity of illness of the patient.
8. Use an EWS system or ‘calling criteria’ to identify patients who are critically ill, at risk of clinical deterioration or cardiorespiratory arrest, or both. In the UK, the National Early Warning Score (NEWS) is recommended.
9. For each patient use a vital-signs chart that encourages and permits the regular measurement and recording of vital signs and of EWS where used, and that also facilitates early recognition of and response to patient deterioration.
10. Ensure that the hospital has a clear policy that requires a timely, appropriate, clinical response to deterioration in a patient’s clinical condition.
11. Introduce into each hospital a clearly identified system for response to critical illness. This will vary between sites, but may include an outreach
service or resuscitation team (e.g. MET) capable of responding to acute clinical crises. The service must be available 24 hours per day. An EWS should be used to trigger calls to this team.  

12. Ensure that all clinical staff are trained in the recognition, monitoring, and management of critically ill patients, and that they know their role in the rapid response system.  

13. Empower staff to call for help when they identify a patient at risk of deterioration or cardiorespiratory arrest.  

14. Use a structured communication tool to ensure effective handover of information between staff (e.g. SBAR - Situation-Background-Assessment-Recommendation).  

15. Ensure that all policies on CPR decisions are based on current national guidance, and ensure that all clinical personnel understand it.  

16. Identify those fully informed patients who do not wish to receive CPR, those patients for whom cardiorespiratory arrest is an anticipated terminal event and for whom CPR would be inappropriate, and those patients who have lost capacity in whom a decision not to attempt CPR is in their best interests.  

17. Audit all cardiac arrests, ‘false arrests’, unexpected deaths and unanticipated ICU admissions, using a common dataset. Audit the antecedents and clinical responses to these events.  

18. Ensure that all hospitals participate in the National Cardiac Arrest Audit to obtain feedback on each hospital’s individual performance in comparison to others, allowing identification of opportunities for improvement.  

19. Audit adherence to each hospital’s policy on CPR decisions and to the adequacy of consideration and recording of decisions about CPR.  

7. Accreditation of the 2015 Guidelines  

NICE has accredited the process used by Resuscitation Council UK to produce its Guidelines development Process Manual. Accreditation is valid for 5 years from March 2015. More information on accreditation can be viewed at https://www.nice.org.uk/about/what-we-do/accreditation.  

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