In-hospital resuscitation: recognising and responding to adults in cardiac arrest

Abstract

Survival rates following in-hospital cardiac arrest remain low. The majority of patients who survive a cardiac arrest will be in a monitored environment, have a witnessed cardiac arrest and present with a shockable rhythm, usually ventricular fibrillation. Nurses have a responsibility to preserve safety, which requires the ability to accurately assess patients for signs of deterioration in physical health, and to provide assistance when an emergency arises in practice. Nurses must work within the limits of their competence and be able to establish the urgency of a situation. Nurses in all areas of practice must be able to recognise the signs of cardiac arrest and know the prompt response sequence required to improve the patient’s chances of survival. This article focuses on inpatient resuscitation in acute healthcare environments and is aimed at staff who may be the first to respond to an in-hospital cardiac arrest. This does not include specialist units such as neurosurgery, intensive therapy units and cardiac catheterisation laboratories, where medical experts are available and clinical priorities may differ.

Keywords

cardiac arrest, cardiopulmonary resuscitation, CPR, defibrillation, emergency care, resuscitation

Aims and intended learning outcomes

The aim of this article is to explore the Resuscitation Council (UK) (RCUK) guidelines for in-hospital resuscitation (Gwinnutt et al 2015) and consider their application to practice. After reading this article and completing the time out activities you should be able to:

» Outline the immediate equipment required for in-hospital resuscitation.
» Understand the in-hospital resuscitation algorithm and the priorities in care.
» Discuss the components of high quality cardiopulmonary resuscitation (CPR).
» Explain the significance of high quality CPR and early defibrillation to improved patient outcomes.
» Differentiate between cardiac arrest and respiratory arrest and know the immediate actions required for both.

Introduction

Cardiac arrest occurs when there is a sudden cessation of sufficient cardiac output, whereas respiratory arrest is defined by the cessation of breathing (Riley 2013). These are clinical emergencies, since if no action is taken one will lead to the other. Survival rates following in-hospital cardiac arrest remain low, with less than 20% of patients surviving to hospital discharge (Nolan et al 2014). The majority of patients who survive will be in a monitored environment, have a witnessed cardiac arrest and present with a shockable rhythm, usually ventricular fibrillation. The RCUK guidelines (Gwinnutt et al 2015) state that the following are crucial to optimise the patient’s chances of survival to hospital discharge:

» Immediate recognition of cardiac arrest.
» Help is called, for example by telephoning 2222.
» CPR is commenced immediately.
If required, defibrillation is performed as soon as possible, ideally within 3 minutes.

There is minimal disruption to chest compressions throughout the resuscitation attempt (Soar et al 2015).

In clinical practice, some aspects of the resuscitation attempt may vary depending on the environment and personnel available at the time of the cardiac arrest, as well as local policy. Nurses must work within their level of competence (Nursing and Midwifery Council 2015) and be able to establish the urgency of a situation. Regardless of their area of practice, all nurses must be able to recognise signs of cardiac arrest and know the prompt response sequence required to improve patient outcomes.

This article focuses on acute in-patient healthcare environments and is aimed at staff who may be the first to respond to an in-hospital cardiac arrest. This does not include specialist units such as neurosurgery, intensive therapy units and cardiac catheterisation laboratories, where medical experts are available and clinical priorities may differ.

**Equipment**

The RCUK (2015) provides quality standards that outline the resuscitation equipment required in the acute care environment. While it is acknowledged this may vary depending on the specialty, they recommend that equipment and layout are standardised across an organisation. Box 1 shows the equipment that should be immediately available in all acute care environments.

**TIME OUT 1**

Consider your current area of practice:

- Do you have a standardised equipment layout? Do you know the layout of your local emergency equipment?

- Look at the equipment list in Box 1. Which items do you have? Can you locate these items immediately? Identify which items are you familiar with, and which you need more knowledge of.

- Can you correctly assemble and operate a single use self-inflating bag (bag-valve-mask device)? How quickly can you have this ready for use?

**Safety**

Before commencing a resuscitation attempt, healthcare staff should be mindful of the need to reduce potential hazards to themselves, the patient and other healthcare staff. Staff should adhere to local moving and handling policies and avoid unnecessary risk (Pitcher et al 2015). Equipment must be single-patient use (RCUK 2015) and personal protective equipment (PPE) should be applied as soon as practical. PPE should be appropriate for the patient’s condition, for example for those with serious infections healthcare staff may need to take additional precautions. This will depend on local policy, but may include face masks and visors, in addition to gloves and an apron.

**Assessing the patient**

Early CPR significantly improves patient survival rates following cardiac arrest (Wissenberg et al 2013). Consequently, it is essential for the initial assessment to be performed promptly, ideally in 30-60 seconds. In the hospital environment, it is unlikely a member of staff will be alone.

**Box 1. List of resuscitation equipment**

**Airway and breathing**

- Pocket mask with oxygen port.
- Oxygen mask with reservoir.
- Self-inflating bag (bag-valve-mask) with reservoir.
- Clear face masks (sizes 3, 4, 5).
- Oropharyngeal airways (sizes 2, 3, 4).
- Nasopharyngeal airways (sizes 6 and 7) and lubrication.
- Portable suction with rigid and flexible catheters.
- Oxygen cylinder with key, if necessary.
- Oxygen tubing.
- Magill forceps.
- Stethoscope.

**Circulation**

- Defibrillator.
- Adhesive defibrillator pads.
- Razor.
- Electrocardiograph electrodes.

**Other items**

- Sharps container and clinical waste bags.
- Personal protective equipment such as gloves, aprons and eye protection.

(Adapted from the Resuscitation Council (UK) 2015)
with no other personnel nearby. As such, they must summon help as soon as possible and make best use of the staff available. Some of the required actions can be carried out concurrently to ensure optimum use of time. Figure 1 shows the rapid sequence required for a patient who has collapsed in a hospital environment.

Early recognition of cardiac arrest has a direct effect on the patient’s chances of survival. When encountering a collapsed or unconscious patient, the first step is to assess their response. In the absence of a pre-existing injury, healthcare staff should gently shake the patient’s shoulders and ask loudly: ‘Are you all right?’ (Perkins et al 2015).

### Responsive patients

If the patient responds, their condition will still require urgent medical review and this should be initiated according to local protocols. While waiting for the emergency team to arrive, the ABCDE (airway, breathing, circulation, disability, exposure) approach (Tables 1 and 2) should be used to assess and manage the patient’s condition (Jevon 2010). The management and care of the patient

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**Figure 1. In-hospital cardiac arrest algorithm**

![In-hospital cardiac arrest algorithm](image)

**TABLE I. Assessment using the ABCDE approach**

<table>
<thead>
<tr>
<th></th>
<th>Assessment</th>
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<tbody>
<tr>
<td>A</td>
<td>Is the patient’s airway patent? At risk? Obstructed?</td>
</tr>
</tbody>
</table>
| B | » Look, listen and feel.  
» Respiration rate.  
» Expansion of chest (bilateral).  
» Note use of accessory muscles.  
» Palpation, percussion, auscultation (if you have the clinical skills and are competent to do this).  
» Blood oxygen saturation (SPO2) level. |
| C | » Heart rate.  
» Capillary refill time.  
» Peripheral pulses.  
» Skin temperature and colour.  
» Blood pressure.  
» Urinary output. |
| D | » AVPU (Alert, Voice, Pain, Unresponsive) scale. This is used as a fast assessment of the patient’s conscious level. The patient is assigned a letter score based on their response. If below ‘A’, a Glasgow Coma Scale (GCS) will be taken. The letter V corresponds approximately to a GCS score of 8, and the patient may be unable to protect their airway.  
» GCS and neurological assessment, if required.  
» Pupils equal and reacting to light. |
| E | » Top to toe examination. |

(Reproduced with kind permission from the Resuscitation Council (UK) 2015)
at this stage will depend on the nurse’s level of clinical expertise. However, as a minimum standard, the patient’s vital signs observations and early warning score should be completed, and monitoring equipment for pulse oximetry, blood pressure and electrocardiograph should be attached (Gwinnutt et al 2015). The pulse oximeter should be placed on the opposite arm to the blood pressure cuff and not distal to it, to optimise the accuracy of oxygen saturation readings.

Oxygen therapy is vital in critical illness and must be titrated to the readings of the pulse oximeter. In the absence of chronic obstructive pulmonary disease (COPD), oxygen should be administered at 15L/minute via a reservoir mask, aiming for an oxygen saturation of 94-98% (O’Driscoll et al 2008). However, for patients who are at risk of hypercapnia, for example those with COPD, oxygen should be delivered at 4L/minute using a 28% venturi mask, aiming for an oxygen saturation of 88-92% (O’Driscoll et al 2008). Venous access and blood samples should be obtained for investigation as soon as personnel with these skills are available (Gwinnutt et al 2015).

The use of a communication tool such as SBAR (Situation, Background, Assessment, Recommendation) (NHS Institute for Innovation and Improvement 2008) or RSVP (Reason, Story, Vital Signs, Plan) (Featherstone et al 2008) is recommended to ensure safe and accurate communication between ward staff and the emergency team. Healthcare staff should be familiar with their local communication strategy and able to use it to relay information.

**TIME OUT 2**

Which communication tool do you use in your clinical practice? Write this down and consider the detailed information that you would provide at each stage in Table 2.

**Unresponsive patients**

In the case of an unresponsive patient, if help has not already arrived, it must be summoned immediately. At the onset of cardiac arrest, cerebral blood flow is reduced to almost zero and this can result in seizure-like activity, which could be mistaken for epilepsy. Staff should therefore have a high index of suspicion of cardiac arrest in the presence of seizures, regardless of whether the patient has a history of epilepsy recorded. It is essential that staff rapidly open the airway and assess the adequacy of breathing in this situation (Perkins et al 2015). Perkins et al (2015) emphasised that ‘the key observations are unresponsiveness and not breathing normally’.

**Airway**

It was previously assumed that the cause of airway obstruction in unconscious adults is the tongue falling onto the posterior pharyngeal wall. However, studies suggest the main site of obstruction is at the
level of the epiglottis (Boidin 1985) or soft palate (Nandi et al 1991). Boidin (1985) established that a head tilt-chin lift manoeuvre was sufficient to open the airway. The patient should therefore be positioned on their back to ease the opening and assessment of the airway (Gwinnutt et al 2015, Perkins et al 2015, Soar et al 2015). If the patient is in bed or on a trolley, this may need to be flattened quickly. The majority of modern beds and trolleys have CPR buttons or levers in place for a quick transition from the upright to supine position. In the absence of suspected cervical spine injury, the head tilt-chin lift manoeuvre should be used to open the patient’s airway (Figure 2) (Jevon 2010).

**TIME OUT 3**
Consider the beds or trolleys in your practice area. Can you manoeuvre them and operate the emergency or CPR device on your clinical area equipment? How often is the function checked? Discuss with a colleague the steps you would take to improve your practice in this area.

If there is a high index of suspicion or risk of cervical spine injury, the airway should be opened with a jaw thrust or chin lift manoeuvre, without tilting the head. If enough healthcare staff are available with the skill of manual in-line stabilisation of the head and neck, this should be performed by an assistant (Jevon 2010, Soar et al 2015). Nevertheless, the requirement to open and maintain an adequate airway is paramount, and attempts to protect the cervical spine must not compromise oxygenation and ventilation (Deakin et al 2010).

**Breathing and circulation**
While maintaining an open airway, staff should direct their eyes to the patient’s chest and take less than 10 seconds to assess for normal breathing and signs of life. In this assessment, staff should (Gwinnutt et al 2015):

- Look for chest movement and normal breathing.
- Listen for breath sounds.
- Feel for breath on your cheek.
- Look for other signs of life, such as swallowing, retching, coughing, speaking, and deliberate movement.

While changes in skin colour were evident in 26% of sudden cardiac arrest cases in the Caucasian population, there is a need to be cautious about using this as a diagnostic factor, because it may not apply to other ethnic groups (Breckwoldt et al 2009). Consequently, Soar et al (2015) noted that changes in skin colour must not be used as an indicator of cardiac arrest. Soar et al (2015) suggested that few healthcare staff are able to perform a combined assessment of a patient’s breathing and pulse competently (Figure 3). However, this technique can be used by healthcare staff who have the appropriate skills and competence.

In sudden cardiac arrest, as cerebral perfusion diminishes, agonal respiration can occur in up to 40% of patients (Rea 2005). Agonal respiration is described as breathing which is slow, occasional, laboured or noisy, irregular gasps (Soar et al 2015), which originate from the neurons of the lower brainstem (Rea 2005). This is not a sign of life and should not be confused with normal breathing. However, since an agonal breathing pattern is associated with improved chance of survival if action is prompt (Bobrow et al
2008), confirmation of cardiac arrest must not be delayed. If in doubt, CPR should be commenced immediately. Performing CPR on non-arrest patients is associated with minimal risk of inflicting serious injury (White et al 2010); however, failing to recognise cardiac arrest and commence CPR will result in suboptimal neurological outcomes or death (Sasson et al 2010, Nehme et al 2015, Perkins et al 2015). Therefore, for an unresponsive adult with no clear signs of life, chest compressions should be commenced and staff should ensure the emergency team is on the way.

In the hospital environment, there is an expectation that with the use of emergency call systems, help will arrive promptly. However, occasionally healthcare staff work alone. Lone workers should summon help and gather emergency equipment, even if it means leaving the patient briefly (Soar et al 2015). In sudden cardiac arrest in adults, the initial cause is almost always a consequence of a primary cardiac event. The cessation of blood flow is abrupt and the blood in the lungs and arterial system remains oxygenated. To capitalise on this, it is recommended that CPR begins with chest compressions and not ventilation (Lubrano et al 2012, Perkins et al 2015). If more than one rescuer is available, one person should initiate chest compressions while another calls the emergency team, gathers emergency equipment and prepares the immediate bed space to facilitate easy access.

The exact order of the resuscitation attempt may vary, but the underlying principles remain the same. In the case of an unresponsive adult with no signs of life, chest compressions should be initiated without delay. The RCUK guidelines advocate that chest compressions (Perkins et al 2015):

- Are delivered in the centre of the patient’s chest.
- Depress the chest to a minimum of 5cm, but do not exceed 6cm.
- Are delivered at a rate of 100-120 per minute.
- Allow the chest to recoil completely after each compression.

TIME OUT 4
Consider the following scenario: you are alone with a patient who suddenly becomes unresponsive and their breathing has changed to a slow laboured pattern. With reference to your clinical area, list the actions you would take and in what order.

Chest compressions
The optimum hand position to deliver chest compressions is the lower half of the sternum (Cha et al 2013), with the heel of one hand placed on this section and the other hand on top. Ideally, this should be performed with the rescuer positioned at the side of the patient (Figure 4). However, in cases where the cardiac arrest has occurred in a confined space, for example a shower cubicle, doorway or narrow corridor, it may be necessary to perform...
Chest compression over the patient’s head (Figure 5).

There is a direct correlation between chest compression depth and survival rates, with depths of 40.3-55.3mm and a peak of 45.6mm resulting in higher survival rates (Stiell et al 2014). Compression depths in excess of 6cm increase the incidence of injury to the patient. Although these injuries are not life-threatening, the recommendation is that depth of compression should not exceed 6cm (Helleuvuo et al 2013).

Chest compression rate refers to the number of compressions in 1 minute (Perkins et al 2015), and should not be confused with the total number of compressions delivered. The peak rate of compressions to achieve return of spontaneous circulation (ROSC) is approximately 125 per minute and ROSC is significantly reduced at higher rates (Idris et al 2012). Furthermore, as compression rates increase, compression depth decreases. Therefore, a compression rate of 100-120 per minute is recommended as the optimum to achieve sufficient balance between rate and depth, and consequently improve the likelihood of ROSC (Perkins et al 2015).

During CPR it is important to avoid leaning on the chest wall, because this results in increased intrathoracic pressure, reduced coronary artery perfusion pressure, and reduction in cardiac output and myocardial flow (Niles et al 2011). Therefore, in addition to maintaining the optimum rate and depth of compression, rescuers should allow the chest to recoil completely. The increased use of pressure-relieving mattresses in clinical practice means that it can be difficult to achieve this. Air-filled mattresses should be deflated according to manufacturer’s guidelines.

While the use of a backboard may provide the required firm, flat surface when a soft or foam mattress is in place (Cloete et al 2011, Nishisaki et al 2012), placement of this must not interrupt CPR or compromise treatment during the resuscitation attempt (Perkins et al 2015).

There is a well-established correlation between prompt commencement and minimal interruption of chest compressions and higher survival rates (Christenson et al 2009). While most studies focus on the effect of disruption to CPR around defibrillation, Vaillancourt et al (2011) established that even for patients who are not in an immediate shockable rhythm, increased time delivering chest compressions and fewer interruptions to these resulted in a higher incidence of ROSC.

Rescuer fatigue can also influence the quality of chest compressions (Foo et al 2010). Consequently, rescuers are encouraged to alternate the personnel delivering chest compressions every 2 minutes (McDonald et al 2013). In practice, some staff prefer to kneel on the bed or trolley to deliver chest compressions, because it can help to maintain their position above the patient. However, Perkins et al (2006) found no significant difference in the quality of chest compressions when a rescuer adopted this strategy or when a backboard was in position. Therefore, this depends on personal preference and rescuer comfort.

The priority is always early recognition of cardiac arrest and prompt initiation of high quality chest compressions, with minimal disruption. When chest compressions are under way, other members of staff should be calling the emergency team and gathering emergency resuscitation equipment. The minimum requirement will be airway adjuncts, oxygen delivery systems (bag-valve-mask device) and a defibrillator.
TIME OUT 5
Consider your clinical area and the strategies you can adopt to deliver high quality chest compressions at a depth of 5-6cm and a rate of 100-120 per minute, allowing the chest to recoil completely, for 2 minutes. Discuss with your colleagues strategies for making the transition between rescuers every 2 minutes as smooth as possible to minimise disruption to CPR.

Oxygen, airway and ventilation
The ratio of chest compressions to ventilation for adults is 30:2. Following delivery of 30 compressions, the most appropriate equipment available should be used to deliver 2 ventilations with supplementary oxygen. This may be a pocket mask; however, a bag-valve-mask device with reservoir bag will provide higher concentrations of oxygen. To make effective use of time, the oxygen supply should be connected and switched on to 15L/minute (Parry and Higginson 2016) while chest compressions continue.

To optimise the delivery of oxygen, one rescuer must use two hands to hold a correctly fitting mask in position. The mask should cover the patient’s mouth and nose, and should not overhang the chin or cover the eyes. The mask should be held in position while simultaneously opening the airway using a head tilt-chin lift or jaw thrust manoeuvre (Parry and Higginson 2016). A second rescuer should squeeze the bag for a duration of 1 second, and deliver a tidal volume of 500-600mL of air, adequate to create visual chest movement (Perkins et al 2015). This tidal volume will also reduce the possibility of gastric inflation and subsequent risk of regurgitation in the unprotected airway (Baskett et al 1996). Ideally, three members of staff should be available for this procedure: one person to hold the mask in place and maintain an open airway, one to squeeze the bag, and one to deliver high quality chest compressions (Figure 6).

This can be achieved with two members of staff if necessary: one to hold the mask in place and maintain an open airway, and the other to deliver high quality chest compressions and squeeze the bag (Figure 7a and b).

After the first ventilation, the chest should be allowed to fall fully before the second breath is delivered. Immediately after the second breath, chest compressions should be recommenced, without waiting for the chest to fall. This sequence should continue at a ratio of 30:2 and the defibrillator attached without interrupting CPR. Similarly, the transition between rescuers every 2 minutes should be planned and efficient to minimise interruptions.

KEY POINT
“To optimise the delivery of oxygen, one rescuer must use two hands to hold a correctly fitting mask in position. The mask should cover the patient’s mouth and nose, and should not overhang the chin or cover the eyes. The mask should be held in position while simultaneously opening the airway using a head tilt-chin lift or jaw thrust manoeuvre (Parry and Higginson 2016)”
KEY POINT

‘It is important to note that a defibrillator should be used as soon as it is available; this should not be withheld to enable delivery of CPR. However, if the cardiac arrest occurs in a clinical area where the patient is unmonitored and defibrillation is delayed, a short period of CPR may be advisable before defibrillation’

Adjuncts to airway management

The airway must be clear of liquid to prevent aspiration. A wide-bore rigid suction catheter, for example a Yankauer suction catheter, can be used to clear the airway of liquid (Aldridge and Jevon 2014). Care must be taken to avoid vigorous use of the Yankauer tube and potential stimulation of pharyngeal reflex (gag reflex), which may induce vomiting. It can be difficult to maintain an open airway for long periods of time using the manual manoeuvres of head tilt-chin lift or jaw thrust alone (Soar et al 2015). Therefore, when encountering difficulty in achieving airway patency using manual techniques, adjuncts such as the nasopharyngeal or oropharyngeal airway can be used (Aldridge and Jevon 2014).

The size of the nasopharyngeal airway corresponds to the internal diameter and a size 6 or 7 is appropriate for most adults (Aldridge and Jevon 2014, Soar et al 2015). It is tolerated by semi-conscious patients but should not be used if basal skull fracture is suspected. Some nasopharyngeal airways have a narrow flange at the end and require the insertion of a safety pin before placement. The pin must be positioned at the side of the flange to permit free access to suction down the airway, should it be required. The nasopharyngeal airway is a potentially life-saving piece of equipment if the airway cannot be opened and the oropharyngeal airway is contraindicated.

The size of oropharyngeal airway required should match the vertical distance from the patient’s incisors to the angle of their jaw, and size 2, 3 or 4 is suitable for small, medium-sized and large adults, respectively (Aldridge and Jevon 2014, Soar et al 2015). This airway is tolerated by unconscious patients, who have no pharyngeal reflex. It is inserted concave way up, then rotated 180° when beyond the soft palate to prevent displacement of the tongue during insertion.

It should be noted that these devices are adjuncts and will not open the airway without the additional head tilt-chin lift or jaw thrust manual manoeuvres. Care should be taken to correctly size and insert the appropriate airway adjunct, and the patient should be assessed continuously to establish if the introduction of airway adjuncts has improved the patency of the airway.

TIME OUT 6

Consider the following scenario:

You are holding on the face mask of a patient during a resuscitation attempt when you notice vomit appearing in the mask. What action should you take? Provide your rationale.

Defibrillation

It is important to note that a defibrillator should be used as soon as it is available; this should not be withheld to enable delivery of CPR. However, if the cardiac arrest occurs in a clinical area where the patient is unmonitored and defibrillation is delayed, a short period of CPR may be advisable before defibrillation (Cobb et al 1999, Wik et al 2003, Nolan et al 2015). The optimal time frame for defibrillation from the onset of cardiac arrest is within 3 minutes (Perkins et al 2015). In the hospital environment, sufficient healthcare staff must be trained to achieve the target of delivering the first shock within 3 minutes of collapse, regardless of location (Spearpont et al 2009, De Regge et al 2012). Some areas have introduced automated external defibrillators (AEDs) to facilitate this. De Regge et al (2012) emphasised the importance of frequent retraining for healthcare staff in the use of AEDs to optimise their use.

Most clinical areas in the UK use defibrillators with self-adhesive pads, although some defibrillators still use paddles. Both are referred to as electrodes. When using an AED, it should be switched on and the voice prompts followed immediately. For both manual defibrillators and AED, the electrodes should be attached to the patient’s bare chest with minimal disruption to chest compressions. Chest compressions should be resumed without delay following delivery of the shock. Transthoracic impedance (TTI) is the resistance to electrical current flow across the chest wall. To reduce TTI, any chest hair should be shaved before placement.
of adhesive defibrillation pads (Bissing and Kerber 2000). Further reduction in TTI can be achieved with smooth application of the adhesive pads to eradicate air bubbles under them.

Electrode pad position should be the standard sternal-apical position, in the absence of any implanted medical device. The sternal electrode is positioned to the right of the sternum, under the clavicle and the left electrode in the mid-axillary line, in approximately the V6 position for ECG (Soar et al 2015). In female patients, reduction in TTI is achieved by avoiding application of the apical electrode directly onto breast tissue (Pagan-Carlo et al 1996).

Peri-shock pauses are defined as ‘pauses in chest compressions before and after defibrillatory shock’ (Cheskes et al 2011). Minimising peri-shock pauses significantly improves the potential for successful defibrillation (Edelson et al 2010) and patient survival to hospital discharge (Cheskes et al 2011). Therefore, in the case of manual defibrillation, chest compressions should continue until the point when the defibrillator is being discharged and resumed immediately following delivery of the shock, ideally within 5 seconds (Soar et al 2015).

**TIME OUT 7**

Consider the following scenario: three healthcare staff (one student, one registered nurse and one healthcare assistant) are present when Mandy collapses in the patient toilet. She is unresponsive with no signs of life. How would you delegate the tasks required to initiate CPR, call help, gather equipment, set up equipment, and attach and operate the defibrillator?

**Risks associated with defibrillation**

**Electrocution of rescuers**

The majority of modern defibrillators are biphasic (deliver electrical current from two vectors), which means lower energy levels can be used to defibrillate successfully. Consequently, the introduction of biphasic defibrillators and use of adhesive pad electrodes has significantly reduced the level of electrical current leakage that rescuers are exposed to when performing chest compressions during defibrillation (Lloyd et al 2008). Despite this reduction in risk, historical safety precautions continue to be taken during defibrillation to prevent electrocution of bystanders (Hoke et al 2009). While there are reports of electrical injury manifesting as tingling and minor burns, no life-threatening electrocution of bystanders has been recorded (Hoke et al 2009). Hoke et al (2009) suggested it may even be ‘electrically safe’ for rescuers to continue with chest compressions during defibrillation, if self-adhesive electrodes are used and examination gloves are worn. However, further research by Deakin et al (2013) established there is no evidence to support the theory that examination gloves reduce the risk of accidental shocks to rescuers. Therefore, RCUK (2015) guidelines contest the notion that wearing examination gloves can be considered ‘electrically safe’.

**Fire risk**

Oxygen-rich environments present a fire risk, and while oxygen fires have been reported (Kelly et al 2013), there is only one record that attributes this directly to defibrillation. This may be as a result of effective practice. Soar et al (2015) advocated continuing to follow these guidelines to minimise risk:

- Remove free-flowing oxygen administration devices, such as masks, nasal cannulae, and bag-valve-mask devices, to a minimum of 1 metre away from the patient’s chest when the defibrillatory shock is being delivered.
- If the circuit is ‘closed’ and the inflation bag is attached to a tracheal tube or supraglottic airway, this can be left in place if there is no residual oxygen.

**Securing and protecting the airway**

Once healthcare staff with advanced airway skills are available, tracheal intubation may be attempted to secure and protect the airway. However, this procedure should not compromise the delivery of high quality CPR, and disruption of it must not exceed 5 seconds (Soar et al 2015). Once the airway is secure, there is no requirement to cease chest compressions to enable ventilation, and continuous compressions should be delivered at a rate of 100-120 per minute, combined with a ventilation rate of 10 breaths per minute. This asynchronous method of compression and ventilation significantly
improves mean coronary perfusion pressures (Soar et al 2015), thereby ensuring the best chance of recovery from the event.

Tracheal intubation requires skill and practice, and not all healthcare staff have the expertise to perform it. An alternative method of airway management may be the insertion of a supraglottic airway, for example a laryngeal mask airway or i-Gel; however, this also requires skill and experience. Asynchronous compression and ventilation may be attempted once a supraglottic airway is in place. Caution should be exerted and the patient observed closely, because there is potential for inadequate ventilation as a result of air leakage, since the supraglottic airway may not secure the airway adequately. If reduced ventilation is observed, CPR should resume at a ratio of 30:2, with compressions paused to permit ventilation (Soar et al 2015).

**Respiratory arrest**

In the event of a respiratory arrest, where the patient is not breathing but has a pulse, there is no requirement for chest compressions. Respiratory arrest can be a primary event or can occur after ROSC. The patient should be ventilated at a rate of 10 breaths per minute and their pulse checked after every minute. If the pulse disappears, CPR should be commenced immediately at a ratio of 30:2.

**TIME OUT 8**

Reflect on the emergency equipment in your clinical area and its location. Having read this article, can you find ways you could improve the speed of response to a cardiac arrest in your area and rapidly begin CPR?

**Conclusion**

It is important for nurses to be aware of the evidence that underpins the RCUK guidelines for in-hospital resuscitation (Gwinnutt et al 2015), and to consider the application of these guidelines to clinical practice. Nurses must work within their level of competence and be able to establish the urgency of a situation. Regardless of their area of practice, all nurses must be able to recognise signs of cardiac arrest and the prompt response sequence required to improve patient outcomes.

On encountering a patient who has collapsed, the nurse must first confirm response. If the patient is responsive, they should seek help, document and record vital signs and report these to the emergency team. If the patient is unresponsive, they should check for signs of life. If there are no signs of life, it is important to ensure help and equipment is on the way and commence chest compressions. Regardless of which equipment arrives first, it should be set up for use while high quality chest compressions continue. However, if all equipment is available simultaneously, attaching the defibrillator and assessing the initial rhythm should always be prioritised.

**TIME OUT 9**

Now that you have completed the article you might like to write a reflective account in preparation for revalidation.

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**References**


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1. What percentage of patients survive in-hospital cardiac arrest to discharge?
   a) 20%
   b) 40%
   c) 60%
   d) 80%

2. Which of the following is not crucial to optimise a patient’s chances of survival following a cardiac arrest?
   a) Cardiac arrest is immediately recognised
   b) There is minimal disruption to chest compressions
   c) Cardiopulmonary resuscitation (CPR) is delayed
   d) Defibrillation is performed as soon as possible

3. The ABCDE approach refers to:
   a) Airway, Breathing, Circulation, Diagnosis and Exposure
   b) Airway, Breathing, Cardiovascular, Disability and Examination
   c) Airway, Breathing, Circulation, Diagnosis and Examination
   d) Airway, Breathing, Circulation, Disability and Exposure

4. Agonal respiration involves:
   a) Fast, laboured, quiet, gasps
   b) Slow, laboured, noisy, gasps
   c) Fast, regular, noisy, gasps
   d) Slow, quiet, regular, gasps

5. Once help has been called for and equipment gathered, CPR should begin with:
   a) Oxygen therapy
   b) Ventilation
   c) Chest compressions
   d) Insertion of an airway adjunct

6. What is the optimal depth of chest compressions?
   a) 3-4cm
   b) 5-6cm
   c) 7-8cm
   d) 8-10cm

7. Which of the following is not considered a sign of life?
   a) Swallowing
   b) Coughing
   c) Agonal respiration
   d) Wretching

8. When using a bag-valve-mask device, what tidal volume of air is required to inflate the chest adequately?
   a) 400-500mL
   b) 500-600mL
   c) 600-700mL
   d) 700-800mL

9. Which measures should be taken to reduce transthoracic impedance?
   a) Ensuring smooth application of electrode pads
   b) Avoiding breast tissue
   c) Shaving any hair on the chest
   d) All of the above

10. What is the maximum time permitted to pause CPR?
    a) 5 seconds
    b) 10 seconds
    c) 15 seconds
    d) 20 seconds

How to complete this assessment
This self-assessment questionnaire will help you to test your knowledge. It comprises ten multiple choice questions that are broadly linked to the article starting on page 50. There is one correct answer to each question.

- You can test your subject knowledge by attempting the questions before reading the article, and then go back over them to see if you would answer any differently.
- You might like to read the article before trying the questions. The correct answers will be published in Nursing Standard on 31 August.

Subscribers making use of their RCNi Portfolio can complete this and other questionnaires online and save the result automatically. Alternatively, you can cut out this page and add it to your professional portfolio. Don’t forget to record the amount of time taken to complete it.

You may want to write a reflective account based on what you have learned. Visit journals.rcni.com/r/reflective-account

This self-assessment questionnaire was compiled by Alex Bainbridge

The answers to this questionnaire will be published on 31 August

The answers to SAQ 855 on assessment of injury severity in patients with major trauma, which appeared in the 3 August issue, are: