Resuscitation

Learning Resources

For use in First Responder Accreditation and Reaccreditation programs

Contents

Introduction

In the event of sudden cardiac arrest, recognition, cardiopulmonary resuscitation early defibrillation and early post resuscitation care are all critical factors associated with improving the chance of successful resuscitation. St John members contribute significantly to improving the likelihood of surviving an out of hospital cardiac arrest

Firstly, St John members play a role in the early recognition. By following DRSABCD members are well placed to recognise a cardiac arrest by identifying that the patient is unresponsive, has an open airway but is not breathing, thereby necessitating the commencement of CPR. Sending for help early (i.e. when it is recognised that the patient is unresponsive / unconscious) will ensure that the time to defibrillation (if a defibrillator is not immediately available), the commencement of advanced care and the commencement of post resuscitation care (if circulation is restored) will not be delayed.

The Chain of Survival

Many components of care have been associated with improved cardiac arrest outcomes. These are often described as the links in the Chain or Survival indicating that every element is critical for good outcomes from cardiac arrest.

St John members play an important role in each of the links in the chain of survival and your value should not be underestimated being well placed to provide three of the four critical links.

Recognition of Cardiac Arrest

One of the key learning outcomes of this module is to improve the ability of St John members to recognise and manage cardiac arrest. This can be challenging for a range of reasons. St John members often arrive at the location of a cardiac arrest very soon after it has occurred. The cessation of coordinated contraction of the heart muscle causes has the greatest initial impact on the brain. The sudden loss of oxygen to the brain causes the brain to begin to malfunction causing dramatic consequences to the brain's normal function including:

1. Within 30 seconds, people lose consciousness.
2. Shortly after unconsciousness, the oxygen starved brain may begin misfiring in some people producing a brief seizure typically lasting less than 30 seconds.
3. Over the initial few minutes the brain may still attempt to breathe resulting in abnormal breathing or "agonal" breathing – this can persist over many minutes.

A seizure can be a sign of cardiac arrest

Following the sudden onset of cardiac arrest the heart ceases to pump oxygenated blood to the brain and other organs. This results in a sudden loss of consciousness due to the lack of oxygenated blood to the brain and explains why patients in cardiac arrest are unresponsive (unconscious). This sudden loss in blood flow (and oxygen) can trigger the brain to have a brief generalised seizure soon after the onset of cardiac arrest. Unfortunately, this seizure, although brief, can be confused for a cause other than cardiac arrest and therefore CPR is not commenced or there are delays to commencing CPR. The key message is that St John members need to assess all patients thoroughly and systematically by using DRSABCD to ensure that the patient is breathing normally (see below). A patient in cardiac arrest will be unresponsive (unconscious) and will **not** be breathing normally.

ACTIVITY - Seizure can be a sign of cardiac arrest

Watch the following video to observe how a brief seizure caused confusion and resulted in the delay of to the commencement of CPR.
http://www.youtube.com/watch?v=DCBifNw3vk8

An unresponsive patient with abnormal or gasping breathing is a sign of cardiac arrest

In most cases of cardiac arrest, the patient is unresponsive and there is no evidence of breathing (i.e. you can not see or feel the chest and abdomen moving, you can not feel or hear the movement of air from the nose or mouth). This establishes the diagnosis of cardiac arrest and the commencement of CPR is the next step.

However, in many cases of cardiac arrest, there is some movement of the abdomen and chest. Does this mean the patient is breathing? St John members need to be aware of **agonal breathing** as the presence of agonal breathing is a common feature which can delay the recognition of cardiac arrest (and delay the commencement of CPR). Agonal breathing originates from the lower brain

brainstem in the early stages of cardiac arrest as the higher centres become progressively hypoxic following the cessation of cardiac output. Reports from out-of-hospital cardiac arrests indicate that agonal breathing may be present in up to 40% of arrests[1]. Agonal breaths are more commonly reported if the arrest is witnessed or care providers arrive on the scene within a short time of the collapse (as would be the case for most St John events). The failure to recognise agonal breathing as a sign of cardiac arrest **leads to delays in the initiation of CPR** which is associated with poorer outcomes[1]. Agonal breathing is not normal (effective) breathing and it needs to be recognised promptly so that CPR can commence.

ACTIVITY – What does agonal breathing look like?

Watch the following video for an example of agonal gasps (abnormal breathing) during cardiac arrest:
http://www.youtube.com/watch?v=hfrv7ZzLcJc&feature=related

To assess breathing you should[2]:

1. LOOK for movement of the upper abdomen or lower chest
2. LISTEN for the escape of air from nose and mouth
3. FEEL for movement of the chest and upper abdomen

ACTIVITY – Will you recognise the signs of cardiac arrest?

Watch the following animations from the Resus Council UK (note call triple ZERO (000) not 999):

1. http://www.youtube.com/watch?v=fXQJ4klzSas&feature=context-cha

2. http://www.youtube.com/watch?v=2a3P8kcYliE&feature=context-cha

If you are uncertain whether the breathing is normal or abnormal in an unresponsive patient – assume it is abnormal and commence CPR.

The key is to recognise that an unresponsive patient with agonal breathing is in cardiac arrest and therefore the management priorities are the same as a patient in cardiac arrest who is not breathing:

1. Early recognition and call for help
2. Early CPR
3. Early defibrillation
4. Post resuscitation care

Commence CPR in any patient who is unresponsive and is not breathing normally

Management of cardiac arrest

In St John we use a “DRSABCD” action plan for the management of cardiac arrest. An action plan is a sequential series of procedures that we need to do to produce a desired outcome. Action plans have a valuable role in times of high emotional stress. Action plans to promote an ordered response in a time of crisis.

DRSABCD action plan

In an emergency call triple zero (000) for an ambulance

St John

D DANGER

Ensure the area is safe for yourself, others and the patient.

R RESPONSE

Check for response—ask name—squeeze shoulders

No response
- Send for help.

Response
- make comfortable
- check for injuries
- monitor response.

S SEND for help

Call Triple Zero (000) for an ambulance or ask another person to make the call.

A AIRWAY

Open mouth—if foreign material is present:
- place in the recovery position
- clear airway with fingers.

Open airway by tilting head with chin lift.

B BREATHING

Check for breathing—look, listen and feel.

Not normal breathing
- Start CPR.

Normal breathing
- place in recovery position
- monitor breathing
- manage injuries
- treat for shock.

C CPR

Start CPR—30 chest compressions : 2 breaths

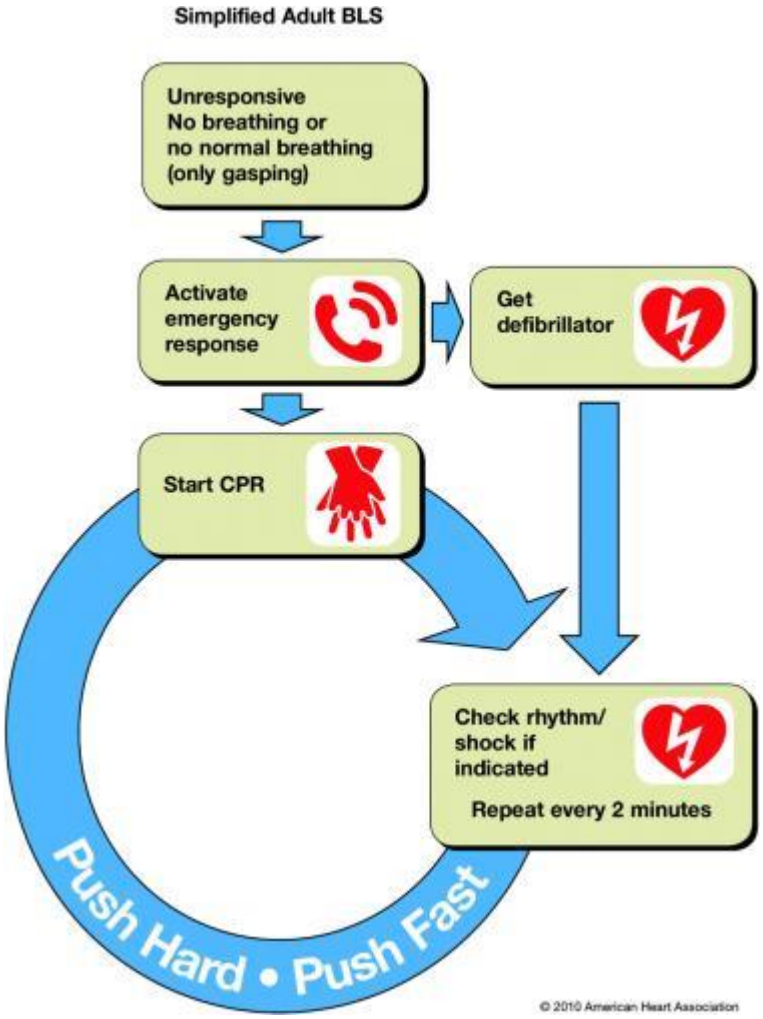
Continue CPR until help arrives or patient recovers.

D DEFIBRILLATION

Apply defibrillator if available and follow voice prompts.

Learn First Aid | 1300 360 455 | www.stjohn.org.au

A simplified conceptual approach described by the American Heart Association is as follows:

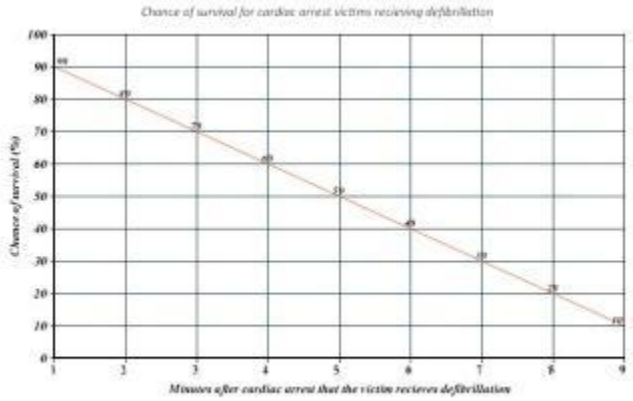


This reiterates the elements of the St John DRSABCD Action Plan - namely early recognition of cardiac arrest (unresponsive with no breathing or no normal breathing), the need to send for help early, the need to start CPR and the need to get a defibrillator to the patients as soon as possible.

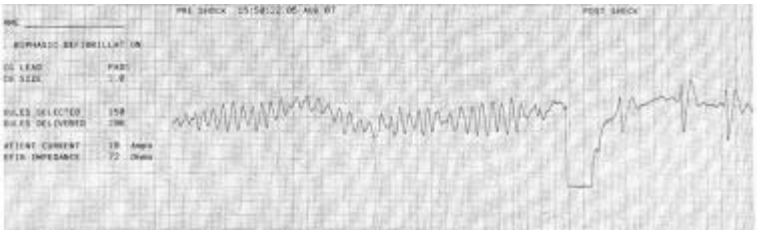
Early defibrillation [4,6]

Early defibrillation is critical to survival from cardiac arrest. This is because the most frequent initial rhythm in out of hospital witnessed cardiac arrest is ventricular fibrillation (VF) of which the treatment for ventricular fibrillation is defibrillation. The patient's chance of survival decreases with an increasing interval between the arrest and defibrillation. Thus early defibrillation remains the cornerstone therapy for ventricular fibrillation and pulseless ventricular tachycardia. A key objective in the management of cardiac arrest is reducing the interval between arrest and defibrillation. One of the determinants of successful defibrillation is the effectiveness of chest compressions. Defibrillation outcome is improved if interruptions (for rhythm assessment, defibrillation, or advanced care) in chest compressions are kept to a minimum.

Several studies have documented the effects of time to defibrillation and the effects of bystander CPR on survival from cardiac arrest. For every minute that passes between collapse and defibrillation, survival rates from witnessed VF cardiac arrest decrease 7% to 10% if no CPR is provided. When bystander CPR is provided, the decrease in survival rates is more gradual and averages 3% to 4% per minute from collapse to defibrillation. CPR can double or triple survival from witnessed cardiac arrest at most intervals to defibrillation.



If bystanders provide immediate CPR, many patients in VF can survive with intact neurologic function, especially if defibrillation is performed within 5 to 10 minutes after SCA. CPR prolongs VF, delays the onset of asystole, and extends the window of time during which defibrillation can occur. Basic CPR alone, however, is unlikely to terminate VF and restore a perfusing rhythm thus the need for early defibrillation.



Early defibrillation is critical to cardiac arrest survival

Improving the quality of CPR

Barriers to improving the quality of CPR have been well described (see Table 1). These are as relevant for St John personnel as they are for healthcare professionals including paramedics, nurses and doctors. Focussing on improving each of these CPR components will likely improve cardiac arrest outcomes.

Table 1: Key challenges to improving CPR quality in adults, infants and children[4]

CPR component	Challenge
Recognition	• Failure to recognise gasping as sign of cardiac arrest • Unreliable pulse detection
Initiation of CPR	• Low bystander CPR response rates • Incorrect dispatch instructions
Compression rate	• Slow compression rate
Compression depth	• Shallow compression depth
Chest wall recoil	• Rescuer leaning on the chest
Compression interruptions	• Excessive interruptions for ○ – rhythm/pulse checks ○ – ventilations ○ – defibrillation ○ – intubation ○ – intravenous (IV) access
Ventilation	• Ineffective ventilations • Prolonged interruptions in compressions to deliver breaths • Excessive ventilation (especially with advanced airway)
Defibrillation	1. Prolonged time to defibrillator availability 2. Prolonged interruptions in chest compressions pre- and post-shocks
Team Performance	• Delayed rotation, leading to responder fatigue and decay in compression quality • Poor communication among rescuers, leading to unnecessary interruptions in compressions

Modified from Travers A H et al. Circulation 2010;122:S676-S684[4]

Post resuscitation care [7,8]

Survival from out of hospital cardiac arrest varies however overall, survival is in the order of 5-10%. In the St John context however, survival is closer to 70-90% as many of the links in the chain of survival are available very soon after the patient arrests.

The goal of all resuscitation attempts is firstly to restore spontaneous circulation (i.e. the heart beating again and supplying vital organs such as the brain with oxygen). Ultimately however, we want patients to survive with a good neurological outcome and ideally at or close to their pre-arrest level of function.

Restoration of circulation is indicated by the return of central and ideally peripheral pulses. Whilst routine pulse checks have been removed from basic life support guidelines this may be observed by a change in the patient's colour towards normal (i.e. from grey / blue / mottled to pale / pink). Further evidence of restoration of spontaneous circulation might be the return of normal breathing. Some patients may even begin to move or wake up.

Once there is evidence of restoration of spontaneous circulation close monitoring of the patient is critical. Start at the beginning of the DRSABCD action plan.

1. Confirm that there is still no danger
2. Assess **responsiveness** → if the patient now responds to pain, voice or is alert then restoration of circulation is likely to have occurred
3. Assess **airway** → ensure that remains clear. If the patient is now unable to tolerate an oropharyngeal airway then restoration of circulation is likely to have occurred
4. Assess **breathing** → if regular breathing has occurred then restoration of circulation is likely to have occurred. If you are uncertain if normal breathing is present in 10 seconds then assume it is not and continue CPR. If breathing is regular but the rate is slow or breathing depth is shallow then you will need to continue supporting ventilation via a self inflating bag
5. Assess **circulation** → assess colour, temperature, central and peripheral pulses and capillary refil. If central and peripheral pulses are present and colour appears normal then restoration of circulation is likely to have occurred. If pulses are palpable then attempt to measure the blood pressure.

There is increasing recognition that systematic post–cardiac arrest care after return of spontaneous circulation (ROSC) can improve the likelihood of patient survival with good quality of life. Post–cardiac arrest care has significant potential to reduce early mortality caused by cardiovascular instability and later morbidity and mortality from organ failure and brain injury.

The initial objectives of post cardiac arrest care are to:

1. Optimize cardiopulmonary function and vital organ perfusion
2. After out-of-hospital cardiac arrest, transport patient to an appropriate hospital with a comprehensive post cardiac arrest treatment system of care

3. Try to identify and treat the precipitating causes of the arrest and prevent recurrent arrest

Subsequent objectives of post cardiac arrest care are to

1. Control body temperature to optimize survival and neurological recovery
2. Identify and treat acute coronary syndromes (ACS)
3. Optimize mechanical ventilation to minimize lung injury
4. Reduce the risk of multi-organ injury and support organ function if required
5. Objectively assess prognosis for recovery
6. Assist survivors with rehabilitation services when required

Whilst most of these elements are beyond the scope of the initial resuscitation phase, it should help you appreciate that the initial links in the chain of survival belong to you and your efforts. In the event of restoration of spontaneous circulation, provide the opportunity for post resuscitation care.

St John members can commence post resuscitation care by attending to the following:

a) Position the patient in the stable side position if breathing normally
b) Ensuring the patient maintains a clear and open airway thereby reducing the risk of any further hypoxic injury (use suction and airway adjuncts as appropriate)
c) Ensuring the patient is not hypoxic by administering supplemental oxygen (if pulse oximetry is available then the target is ≥ 94%). If breathing normally then a medium flow mask with 8 L/min oxygen flow would be sufficient. If hypoventilating (rate too slow or depth too shallow) supporting ventilation with self inflating bag (BMV) but avoid hyperventilation (i.e. keep ventilation rate within normal limits for age)
d) Closely monitor vital signs including respiratory rate (and effort), pulse rate (and volume), blood pressure, temperature and blood glucose
e) Treat hypoglycaemia (BGL < 4) if accredited to do so (glucose gel if patient has LOC A otherwise glucagon if LOC is V, P or U)
f) Avoid hyperthermia – hypothermia is beneficial to patients with out of hospital arrests due to ventricular fibrillation. Protect the patient from environmental extremes. If patient is hyperthermic then cooling is appropriate.
g) Treat other specific conditions – e.g. if patient LOC A and has a suspected heart attack then administer aspirin

In the event of restoration of spontaneous circulation regularly repeat a systematic primary survey (ABCDE) to detect changes in the condition of the patient. If unresponsive and not breathing normally – recommence CPR (DRSABCD)

Resuscitation frequently asked questions:

What is an approach to the management of a cardiac arrest with two responders?

The key is to think about roles and functions. If there is a single responder then the responder will need to do everything and the best approach is to follow DRSABCD in

sequence – assess for danger, check responsiveness, send for help (and a defibrillator), open the airway, assess breathing, commence CPR and apply a defibrillator when available and to continue until help arrives. This situation is uncommon in practice however.

Thinking about what is known about sudden cardiac arrest and the elements that are known to improve survival, the following is an approach if there are two responders (assuming you have responded with a defibrillator and oxygen).

The priorities are:

1. Early recognition and call for help
2. Early (and high quality) CPR
3. Early defibrillation
4. Post resuscitation care

Responder 1	**Responder 2**
Commence DRSABCD – when cardiac arrest is recognised, <u>immediately</u> commence chest compressions (ideally expose the chest)	Send for help, advise location, ensure triple zero (000) is called for an ambulance, request additional responders
Continue chest compressions 100 / minute. When Responder 2 is ready to ventilate, cease compressions and apply defibrillator.	Prepare to ventilate patient (BMV + 100% oxygen). Insert oropharyngeal airway, open airway. When ready, advise Responder 1 you are ready to ventilate. Give two ventilations to achieve rise and fall of chest. Take over CPR 30:2
Turn on and follow voice prompts. Apply defibrillation electrodes – if shock is indicated – ensure oxygen is off the patient and everybody is safe (look at the top, middle and bottom of the patient)	When AED states to “stand clear” remove oxygen from the patient and ensure you are safe
If shock is indicated – press to shock	Immediately following shock, commence CPR
Continue CPR 30:2 (ideally do not do chest compressions for longer than 2 minutes)	
Follow prompts of AED –reanalyse rhythm every 2 minutes	
Continue CPR and defibrillation until paramedics arrive or signs of life return (e.g. consciousness, movement, regular breathing, colour improves) swapping roles every 2 minutes	
Integrate other bystanders / responders to assist with high quality chest compressions	
When sufficient resources are present, use a two-person technique to maintain the airway and to ventilate the patient	
Complete Patient Record and National Cardiac Arrest Data Collection form	
Debrief and self care – cardiac arrest is a significant event and unfortunately not everybody will survive - consider peer support, chaplaincy services and employee assistance programs	

Given the emphasis on high quality chest compressions with minimal interruptions, when it is reasonable to interrupt chest compressions?

Common reasons to interrupt chest compressions include:

- To change responder doing compressions (recommended after every 5 cycles i.e. 2 min. to prevent fatigue)
- To apply a defibrillator (this is not always necessary)
- When prompted by the defibrillator (i.e. “Stand Clear”)

There may be other situations (e.g. you may be asked to stop briefly when medical emergency response teams or paramedics arrive) it is recommended that all interruptions are less than 10 seconds in duration – less compressions is associated with poorer outcomes.

Is bag mask ventilation difficult in cardiac arrest?

The short answer is YES, it often is. In order to perform bag mask ventilation effectively you need to have a good seal with the mask, an open airway, and the ability to make the chest rise and fall. Ensure the mask you use is the correct size for the patient – First, it is important to choose the correct size for your patient. It should sit over the bridge of the patient’s nose with the upper border aligned with the pupils. The sides should seal just lateral to the junction of the nose and the upper lip with the bottom of the face mask sitting between the lower lip and chin.

Two techniques are commonly described – one handed and two handed (two handed is recommenced but is not always practical):

One handed technique[5]:

1. Place the correct size mask over the nose and mouth
2. Use your non-dominant hand to position the facemask, holding the body of the mask between your thumb and index finger (forming a C).
3. Use your remaining 3 fingers to support the jaw, with your little finger hooked behind the angle of the mandible (forming an E). Note - be careful not to place pressure on sub-mandibular soft tissues as this may occlude the airway, especially in paediatric patients
4. Lift the mandible upwards, towards and into the mask to create an air-tight seal.
5. Slight head extension may improve airway patency.
6. Ventilate the patient with your dominant hand by squeezing the self inflating bag
7. Continually assess the adequacy of the technique by observing bilateral chest movement, listening for air leaks and assessing for signs of inadequate facemask ventilation

An oropharyngeal airway (when available) should be inserted when performing bag mask ventilation in an unconscious patient, especially when in cardiac arrest.

This is called the EC clamp technique of bag mask ventilation.[4]

Two hand technique[5]:

As with the one-handed technique, the aim is to ensure a complete seal of the mask to the patient's face and maintain airway patency. There are two main approaches for this technique (Figure 5). The first uses a similar approach to the one-handed technique described above, with the additional hand adopting an identical position on the other side of the mask and face.

Alternatively, the mask can be supported with the thumbs while the index and middle fingers hook behind the angle of the jaw.

Open the airway by lifting the mandible (jaw) towards the mask rather than pushing the mask downward onto the face

ACTIVITY – See the chain of survival in action

Watch an actual resuscitation from the Sydney Running Festival September 2011 by St John (NSW) volunteers (including defibrillation):

http://au.news.yahoo.com/a/-/newshome/10294356/marathon-man-back-from-the-dead/

References and resources

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