AUSTRALIAN RESUSCITATION COUNCIL

NEW ZEALAND Resuscitation Council
Whakahauora, Aotearoa

GUIDELINE 11.1.1

CARDIOPULMONARY RESUSCITATION FOR ADVANCED LIFE SUPPORT PROVIDERS

INTRODUCTION

The purpose of cardiopulmonary resuscitation is to provide sufficient vital organ blood flow (eg. to brain, heart) to preserve life until the definitive procedures can be performed (eg. defibrillation, correction of underlying cause). Compared with BLS providers, ALS providers are more likely to have performed and practised CPR. Despite this, observational studies of the actual performance of CPR by heath care professionals have revealed inadequate depth of compressions,[1] excessive ventilation rates,[2] and excessive interruptions to external cardiac compressions.[3] The general principles of cardiopulmonary resuscitation remain the same for ALS providers as for BLS providers: provide good quality compressions, minimise interruptions to compressions, fill the lungs with oxygen and avoid excessive ventilation.

Healthcare providers (HCPs) should be trained to start CPR with chest compressions for adult victims of cardiac arrest. If they are trained to do so, they should perform ventilations. Performing chest compressions alone is reasonable for trained individuals if they are incapable of delivering airway and breathing maneuvers to cardiac arrest victims.[4]

The risk of disease transmission is very low and initiating rescue breathing without a barrier device is reasonable. If available, rescuers may consider using a barrier device.[4] Rescuers should take appropriate safety precautions, especially if a victim is known to have a serious infection (e.g. human immunodeficiency virus (HIV), tuberculosis, hepatitis B virus or severe acute respiratory syndrome (SARS)).[4]

It is reasonable to wear personal protective equipment (PPE) (e.g. gloves) when performing CPR. CPR should not be delayed or withheld if PPE is not available unless there is a clear risk to the rescuer.[4] There are few reports of psychological harm to rescuers after being involved in a resuscitation attempt. There is insufficient evidence to support or refute any recommendation on minimizing the incidence of psychological harm to rescuers.[4]

There is insufficient evidence to recommend for or against physicians versus non-physician providers of ALS during prehospital cardiopulmonary resuscitation.[4]

WHEN TO COMMENCE CPR

The sequence of events for BLS is the same for ALS providers (see Guideline 8). If the victim is not responsive, the airway should be cleared and breathing assessed, and if the victim is not breathing normally, then CPR should be commenced with 30 compressions followed by 2 breaths (see Guideline 8).

Recommendation

It is reasonable that lay rescuers and health care professionals use the combination of unresponsiveness and absent or abnormal breathing to identify cardiac arrest.[5] A pulse check (even in the hands of healthcare professionals) has limitations[6] but if an ALS provider is trained in that technique they can also check for a central pulse (eg. carotid) for up to 10 seconds during the period of assessment for signs of life [Class A; LOE Expert Consensus Opinion].

Palpation of the pulse as the sole indicator of the presence or absence of cardiac arrest is unreliable. Agonal gasps are common during cardiac arrest and should not be considered normal breathing. The general public and healthcare workers should be taught how to recognize agonal gasps as a sign of cardiac arrest.[5]

WHERE TO COMPRESS

There is insufficient evidence to support any particular technique for identifying a compression point or a specific hand position for chest compressions during CPR in adults. Manikin studies in healthcare professionals showed improved quality of chest compressions when the dominant hand was in contact with the sternum.[7] The desired compression point for CPR in adults is over the lower 1/2 of the sternum. Compressions provided higher than this becomes less effective, and compressions lower than this are less effective and have an increased risk of damage to intra-abdominal organs. Two techniques were previously taught to find this compression point (eg. caliper method and alternative method). There were shorter pauses between ventilations and compressions if the hands were simply positioned "in the centre of the chest".[7]

Recommendation

For adults receiving chest compressions, it is reasonable for rescuers to place their hands on the lower half of the sternum. It is reasonable to teach this location in a simplified way, such as, "place the heel of your hand in the center of the chest with the other hand on top." This instruction should be accompanied by a demonstration of placing the hands on the lower half of the sternum. Use of the internipple line as a landmark for hand placement is not reliable.[5]

DEPTH OF COMPRESSION

Despite ALS training and regular practice, in both out-of-hospital and in-hospital observational studies, insufficient depth of compression (when compared with currently recommended depths) was commonly observed during CPR. Three adult human studies show that the measured compression depth during adult human resuscitation is often less than the recommended lower limit of 4 cm). No human studies directly compared the effectiveness of currently recommended compression depth of 4-5 cm with alternative compression depths.

The ideal depth of compression for human cardiac arrest management remains unknown. One adult human case series two adult human studies with retrospective control groups, and one additional study suggest that compressions of 5 cm or more may improve the success of defibrillation and ROSC. These findings are supported by three swine studies showing improved survival with deeper compression depths, and one adult human study showing that improved force on the chest produced a linear increase in systolic blood pressure. However, one swine study reported no improvement of myocardial blood flow with increased compression depth from 4 cm to 5 cm although coronary perfusion pressure (CPP) improved from 7 to 14 mm Hg.[5]

There is a high degree of variability in the size and shape of adult chests. In one CT study of 100 patients, compression depths of 4-5 cm equated to approximately 16-21% of the depth (antero-posterior diameter) of an adult chest.[9]

The force necessary for initial chest compression is minimal but the force necessary for further compression increases in a curvilinear fashion.

Recommendation

When performing chest compressions in adults it is reasonable to compress the sternum at least one third of the depth of the chest [Class B; LOE Expert Consensus Opinion] or at least 5cm for all adult cardiac arrest victims, [Class A; LOE IV]. There is insufficient evidence to recommend a specific upper limit for chest compression depth.[5]

RATE OF COMPRESSION

The optimal rate of cardiac compression during cardiac arrest in adults is not known. Some studies in animal models of cardiac arrest showed that high-frequency CPR (120-150 compressions/min) improved haemodynamics without increasing trauma when compared with 60 compressions/min, whereas others showed no such benefit. Some studies in animals showed more effect from other variables, such as duty cycle (see below). In humans, high-frequency CPR (120 compressions/min) improved haemodynamics over 60 compressions/min.[10] However, in observational studies of mechanical CPR in humans high-frequency CPR (up to 140 compressions/min) showed no improvement in haemodynamics when compared with 60 compressions/min.[7] In a recent human study, compression rates of <87 per minute were associated with less ROSC that rates greater than 87 and rates > 120 offered no benefit above rates between 100 and 120/min.[21]

Recommendation

It is reasonable for lay rescuers and healthcare providers to perform chest compressions for adults at a rate of approximately 100 compressions per minute, or just under 2 compressions per second [Class A; LOE III, Animal studies, Expert Consensus Opinion]. There is insufficient evidence to recommend a specific upper limit for compression rate. There is no evidence that a compression rate over 120 / minute offers any advantage. [Class A; Expert Consensus Opinion] Pauses should be minimized to maximize the number of compressions delivered per minute.[5]

COMPRESSION: RELAXATION RATIO (DUTY CYCLE)

The term duty cycle refers to the time spent compressing the chest as a proportion of the period between the start of one compression and the start of the next.

Coronary blood flow is determined partly by the duty cycle (reduced coronary perfusion with a duty cycle >50%) and partly by how fully the chest is relaxed at the end of each compression. One animal study that compared duty cycles of 20% with 50% during cardiac arrest chest compressions showed no statistical difference in neurological outcome at 24 h. A mathematical model of Thumper CPR showed significant improvements in pulmonary, coronary, and carotid flow with a 50% duty cycle when compared with duty cycles of > 50%.

At duty cycles of between 20 and 50%, coronary and cerebral perfusion in animal models increased with chest compression rates of up to 130-150 compressions/min. In a manikin study, duty cycle was independent of the compression rate when rescuers increased progressively from 40 to 100 compressions/min. A duty cycle of 50% is mechanically easier to achieve with practice than duty cycles of <50%.[7]

Recommendation

It is reasonable to use a duty cycle of 50% (ie. equal time spent in compression and release). [Class A; LOE Other: Manikin & Animal studies]

DECOMPRESSION

There are no human studies specifically evaluating ROSC or survival to hospital discharge with or without complete chest wall recoil during CPR. One out-of-hospital case series documented a 46% incidence of incomplete chest recoil by professional rescuers using the CPR technique recommended in 2000, and two in-hospital pediatric case series demonstrated a 23% incidence of incomplete recoil that was more common just following switching providers of chest compressions. Another study electronically recorded chest recoil during in-hospital pediatric cardiac arrests and found that leaning on the chest occurred in half of chest compressions. Animal studies demonstrate significant reductions in mean arterial pressure, coronary perfusion pressure, cardiac output, and myocardial blood flow with only small amounts of incomplete chest recoil. Chest recoil can be increased significantly with simple techniques; for example, lifting the heel of the hand slightly but completely off the chest during CPR improved chest recoil in a manikin model. However, these alternative techniques may also reduce compression depth.[5]

Recommendation

While allowing complete recoil of the chest after each compression may improve circulation, there is insufficient evidence to determine the optimal method to achieve the goal without compromising other aspects of chest compression technique.[5]

PROVISION OF A FIRM SURFACE FOR CPR

One case series and four manikin studies demonstrated that chest compressions performed on a bed are often too shallow.[5] No studies have examined the risks or benefits of moving the patient from a bed to the floor to perform CPR.[5] No studies in humans have evaluated the risks or benefits of placing a backboard beneath a patient during CPR. Manikin studies suggested that placing a backboard may improve compression depth by a few millimeters. [5] One manikin study showed that deflating a special mattress improved compression efficiency, but another manikin study failed to demonstrate any benefit from deflating an air-filled mattress.[5]

Recommendation

CPR should be performed on a firm surface when possible. Air filled mattresses should be routinely deflated during CPR. There is insufficient evidence for or against the use of backboards during CPR. If a backboard is used, rescuers should minimize delay in initiation of chest compressions, minimize interruption in chest compressions, and take care to avoid dislodging of catheters and tubes during backboard placement.[5] [Class A; LOE Manikin study] Rescuers who use devices that provide feedback on CPR quality should be aware of the potential overestimation of compression depth when the victim is on a soft surface.

MINIMISE INTERRUPTIONS TO CPR

Interruptions in external cardiac compressions result in a fall in coronary perfusion pressure, [12] and an associated decrease in the likelihood of successful defibrillation.[8, 13]

Recommendation

Rescuers should minimize interruptions of chest compressions during the entire resuscitation attempt.[5] CPR should be continued without interruptions unless signs of responsiveness of normal breathing return or it is necessary to stop to perform specific tasks (eg. endotracheal intubation, rhythm analysis or defibrillation). It is recommended that attempts at intubation should ideally not interrupt cardiac compressions at all. For healthcare professionals, it is reasonable to check a pulse if an organized rhythm is visible on the monitor at the next rhythm check.[5]

The planned pauses in cardiac compressions for rhythm analysis (and/or pulse check) should not take more than 10 seconds, and compressions should be continued up until the time of defibrillation. Ensure that shocks are delivered only when all rescuers are well clear of the patient.

COMPRESSION:VENTILATION RATIO

There is insufficient evidence that any specific compression:ventilation ratio is associated with improved outcome in patients with cardiac arrest.[5] The minute ventilation requirements during cardiac arrest are not known. A normal respiratory rate of 10-12 breaths per minute may be detrimental in the presence of low cardiac output (including during cardiac arrest). In a recently published animal study, 12 breaths per minute appeared excessive.[2] Emphasis should be placed on trying to oxygenate the aortic blood rather than removing carbon dioxide during low flow states. Oxygen should be administered as soon as possible.

Recommendation

Professional rescuers should provide chest compressions with ventilations for cardiac arrest victims. There is insufficient evidence to support or refute the provision of chest compressions plus airway opening and oxygen insufflation by professional rescuers during the first few minutes of resuscitation from cardiac arrest.[5] To increase the number of compressions given, minimise interruptions of chest compressions, and simplify instruction for teaching and skills retention, a single compression: ventilation ratio of 30:2 is recommended before the airway is secured irrespective of the number of rescuers. [Class A; LOE Expert Consensus Opinion]

After an advanced airway (e.g. endotracheal tube, Combitube, laryngeal mask airway [LMA]) is in place, ventilate the patient's lungs with 100% oxygen to make the chest rise. During CPR for a patient with an advanced airway in place it is reasonable to ventilate the lungs at a rate of 6 to 10 ventilations per minute without pausing during chest compressions to deliver ventilations. [Class A; LOE Expert consensus opinion] Compressions need not be paused, but ventilations will need to be timed with compressions. Simultaneous ventilation and compression may adversely effect coronary perfusion,[10] and has been associated with decreased survival.[11] As previously recommended, one starting point to provide consistent ventilation and an adequate minute volume while minimising interruptions to CPR, and minimising the likelihood of excessive ventilation, is to provide one breath after each 15 compressions (delivering the breath during the relaxation phase of compression, without a significant pause).[14] [Class B; LOE Expert Consensus Opinion] See also Guideline 11.6.

The adequacy of ventilation with supraglottic airway devices during uninterrupted chest compressions is unknown. Theoretically 30:2 may be used in patients with an advanced airway (ETTs LMAs and other supraglottic arways). This has advantages for simplicity of teaching, allows intermittent assessment of adequacy of ventilation, and overcomes the problems associated with inefficient ventilation if breaths are delivered at the same time as the peak of the compressions. [Class B; LOE Expert consensus opinion]

Adequacy of chest rise and fall must be assessed for each breath, but it is easier to ensure that a single delivered breath is adequate once the airway has been secured.
For mouth-to-mouth ventilation for adult victims using exhaled air or bag-mask ventilation with room air or oxygen, it is reasonable to give each breath within a 1 second inspiratory time and an approximate volume of 600 ml to achieve chest rise. It is reasonable to use the same initial tidal volume and rate in patients regardless of the cause of the cardiac arrest.[5]
Use the same initial tidal volume and rate in patients regardless of the cause of the cardiac arrest [Class B; LOE Expert Consensus Opinion].

FATIGUE

The compression rate and depth is variable among rescuers and compressions may be worse in the first 5 minutes of the arrest.[1] One manikin study of rescuer CPR showed that compressions became shallow within one minute, but providers became aware of fatigue only after 5 min.[7]

Recommendation

When feasible, rescuers should frequently alternate "compressor" duties (eg. every 2 minutes), regardless of whether they feel fatigued, to ensure that fatigue does not interfere with delivery of adequate chest compressions. [Class A; LOE Manikin study] Rescuer fatigue may be demonstrated by deterioration in chest compression quality, in particular, depth of compressions. The change of rescuers performing chest compressions should be done with minimum interruption to the compressions.[5]

PERFORMING CPR WHILE PREPARING TO ADMINISTER A SHOCK

When using a defibrillator in manual mode, it is safe to charge the defibrillator while chest compressions continue in preparation for rhythm analysis and possible defibrillation.[15] This approach is not applicable when using a defibrillator in AED mode.

There is insufficient evidence to recommend that continuing manual chest compressions during shock delivery for defibrillation is safe. It is reasonable for rescuers to wear gloves when performing CPR and attempting defibrillation (manual and/or AED) but resuscitation should not be delayed/withheld if gloves are not available.[4]

RECOMMENCE CPR IMMEDIATELY AFTER A SHOCK

The recommendation to immediately start/recommence CPR after a shock is based on the observation that in the first minute or so after defibrillation the chance of developing a rhythm associated with an output is extremely small.[16] Starting CPR immediately after defibrillation, irrespective of the electrical success (or otherwise) of the attempt at defibrillation, restores blood flow to the brain and heart and creates a milieu more conducive to return of spontaneous circulation. A period of good CPR (e.g. for 1-3 minutes) appears to be able to increase the likelihood of success of the next attempt at defibrillation[8, 18]

Five animal studies and one human study confirmed that more interruption of chest compressions during CPR reduced ROSC and survival.[5] In two case series, a palpable pulse was rarely present immediately after defibrillation, suggesting that a pulse check after a shock is not useful and delays the resumption of chest compressions.[5]

In two adult out-of-hospital witnessed VF studies with historical controls and three animal studies immediate resumption of chest compressions after defibrillation was associated with better survival rates and/or survival with favorable neurological outcome compared with immediate rhythm analysis and delayed resumption of chest compression.[5] However, in one randomised study, immediate resumption of chest compressions after defibrillation was associated with earlier VF recurrence when compared to a pulse check prior to resumption of CPR; there was no difference in cumulative incidence of VF 60 s after the shock.[5]

Recommendation

CPR should be started/recommenced immediately after attempting defibrillation, irrespective of the apparent electrical success (or otherwise) of the attempt [Class A; LOE Expert Consensus Opinion].

After about 2 minutes of CPR, or earlier if responsiveness or normal breathing become apparent, the rhythm should be checked. If a rhythm compatible with spontaneous circulation is observed then the pulse should also be checked [Class A; LOE Expert Consensus Opinion].

MONITORING ADEQUACY OF CPR

The simplest and most important component of monitoring is the clinical assessment of the adequacy of CPR: observation of the appropriateness of the technique of compressions (positioning, rate and depth) and ventilation (rate, and depth). Such monitoring will allow feedback regarding technique and possible fatigue.

A number of devices may also be available to monitor the adequacy of CPR.[22] Eleven studies showed that physiologic monitoring values (end tidal CO_2, coronary perfusion pressure, venous oxygen saturation) increased when return of spontaneous circulation was achieved and may be an indication of ROSC before it can be seen in vital signs.[20]

End-tidal carbon dioxide monitoring to guide therapy during cardiac arrest

No studies have addressed this question directly. In experimental models, the end-tidal carbon dioxide concentration during ongoing CPR correlated with cardiac output, coronary perfusion pressure, and successful resuscitation from cardiac arrest. Thirteen studies indicated that higher maximal end-tidal CO_2 levels can predict ROSC. Seven studies demonstrate that end-tidal CO_2 values <1.33 kPa (10 mmHg) obtained after intubation and during CPR efforts are associated with a low probability of survival from cardiac arrest. However, two studies documented patients who did not meet the $ETCO_2$ range but who survived. Multiple studies by one group showed that when $ETCO_2$ exceeded 10 mm Hg, all patients achieved ROSC. In one of these studies all the survivors had an initial $ETCO_2$ higher than 10mmHg. Similarly, two studies showed that if the $ETCO_2$ did not exceed 10 mmHg, survival was zero.[20] Two prospective human studies demonstrated a significant increase in end-tidal CO_2 when ROSC occurs.[20]

Recommendation

Quantitative measurement of end tidal CO_2 may be a safe and effective non-invasive indicator of cardiac output during CPR and may be an early indicator of return of spontaneous circulation in intubated patients. Continuous capnography or capnometry monitoring, if available, may be beneficial by providing feedback on the effectiveness of chest compressions.[20]

Although low values of end tidal CO_2 are associated with a low probability of survival, there are insufficient data to support or refute a specific cut off of end tidal CO_2 at different time intervals as a prognostic indicator of outcome during adult cardiac arrest.

During a cardiac arrest, the $ETCO_2$ value should not be used as a guide for ventilation, and rescuers should be wary about using it to guide ventilation in the immediate post resuscitation phase.

Arterial blood gas monitoring during cardiac arrest

There was evidence from one case series and 10 other related studies that arterial blood gas values are not accurate indicators of the magnitude of tissue acidosis during cardiac arrest and CPR in both the in-hospital and out-of-hospital settings. The same studies indicate that both arterial and mixed venous blood gases are required to establish the magnitude of the tissue acidosis.

Arterial blood gas analysis alone can disclose the degree of hypoxaemia. Arterial blood gas analysis can also highlight the extent of metabolic acidosis. Arterial $PaCO_2$ is dependent on the balance of minute ventilation and cardiac compression (cardiac output) during CPR.

Improvements in blood gases may be due to better ventilation or increased cardiac output and are thus only an approximate indicator of the adequacy of ventilation during CPR. If ventilation is constant, an increase in $PaCO_2$ is a potential marker of improved perfusion during CPR.[19]

Recommendation

Arterial blood gas monitoring should be considered during cardiac arrest as it enables estimation of the degree of hypoxaemia and the adequacy of ventilation during CPR but is not a reliable indicator of the extent of tissue acidosis. [Class A; LOE II-IV, Other]

Low levels of $PaCO_2$ may indicate a need to reduce the respiratory rate. High levels of $PaCO_2$ may need to be tolerated during resuscitation attempts, as the potential benefits of increasing the ventilation rate during CPR must be balanced against the potential detrimental effects (increased intra-thoracic pressure, and decreased coronary perfusion pressure[2]). Blood sampling also allows estimation of electrolyte concentrations (including potassium, calcium and magnesium).

Coronary perfusion pressure to guide resuscitation

Coronary perfusion pressure (CPP; aortic relaxation [diastolic] pressure minus the right atrial relaxation pressure) during CPR in humans correlated with both myocardial blood flow and ROSC: a value ≥15mmHg is predictive of ROSC. Increased CPP correlated with improved 24-h survival in animal studies and is associated with improved myocardial blood flow and ROSC in animal studies involving adrenaline, vasopressin, and angiotensin II.[19]

Recommendation

Coronary perfusion pressure can be used as a guide to therapy during cardiac arrest [Class B; LOE III-2].

In an intensive care facility the availability of direct arterial and central venous pressure monitoring makes calculation of CPP potentially useful. Outside the intensive care facility the technical difficulties of invasive monitoring of arterial and central venous pressure make it difficult to calculate CPP routinely during cardiac arrest.

REAL-TIME FEEDBACK DEVICES

Eleven studies investigated the effect of giving real-time CPR performance feedback to rescuers during actual cardiac arrest events in both in-hospital and out-of-hospital settings. Two studies with concurrent controls in adults and one study with concurrent controls in children showed improved end-tidal CO2 measurements and consistent chest compression rates when feedback was provided from audio prompts (metronomes or sirens).[5]

In four studies with retrospective controls, and two case series, real-time feedback from force transducers and accelerometer devices was useful in improving CPR quality metrics, including compression depth, rate, and complete chest recoil.[5]

Two manikin studies demonstrated the potential for overestimating compression depth when using an accelerometer chest compression feedback device if compressions are performed (with or without a backboard) on a soft surface. No studies to date have demonstrated a significant improvement in long-term survival related to the use of CPR feedback/prompt devices during actual cardiac arrest events.[5]

Recommendation

Real-time chest compression-sensing and feedback/prompt technology (i.e. visual and auditory prompting devices) may be useful adjuncts during resuscitation efforts. However, rescuers should be aware of the potential overestimation of compression depth when the victim is on a soft surface.[5]

CPR prompt /feedback devices may be considered for clinical use as part of an overall strategy to improve the quality of CPR. Instructors and rescuers should be made aware that a compressible support surface (e.g. mattress) may cause a feedback device to overestimate depth of compression.[4]

AUDIT, FEEDBACK AND QUALITY IMPROVEMENT

In a number of case series, the CPR compression rate and depth provided by lay responders, physician trainees and emergency services personnel were insufficient when compared with the methods recommended at that time.[7] Ventilation rates and durations higher or longer than recommended when CPR is performed impaired haemodynamics and reduced survival rates in animals.[2] It is likely that poor performance of CPR in humans also impairs haemodynamics and possibly survival rates. Allocating personnel or equipment to specifically monitor the rate and depth of compressions and ventilation may improve performance.

Recommendation

It is reasonable for instructors, trainees, providers, and emergency services to monitor and improve the process of CPR to improve the CPR quality by ensuring adherence to recommended compression and ventilation rates and depths. [Class B; LOE Expert Consensus Opinion] It is reasonable to recommend the use of briefings and debriefings during both learning and actual clinical activities.[4] [Class B; LOE Expert Consensus Opinion]

It is reasonable to use cognitive aids (e.g. checklists) during resuscitation provided they do not delay the start of resuscitation efforts. Aids should be validated using simulation or patient trials, both before and after implementation to guide rapid cycle improvement.[4][Class B; LOE Expert Consensus Opinion]

HARM TO PATIENTS DURING CPR

Post-mortem studies have identified a significant number of thoracic injuries after CPR.[17] There are no data to suggest that the performance of CPR by bystanders leads to more complications than CPR performed by professional rescuers. One study documented no difference in the incidence of injuries on chest radiograph for arrest victims with and without bystander CPR. One study documented a higher rate of complications among inpatient arrest victims treated by less-experienced (non-ICU) rescuers. Two studies reported that serious complications among non-arrest patients receiving dispatch-assisted bystander CPR occurred infrequently. Of 247 non-arrest patients with complete follow up who received chest compressions from a bystander, 12% experienced discomfort; only 5 (2%) suffered a fracture; and no patients suffered visceral organ injury.[23]

Recommendation

In individuals with presumed cardiac arrest, bystander CPR rarely leads to serious harm in victims who are eventually found not to be cardiac arrest; and therefore bystander CPR should be assertively encouraged.[5] [Class A; LOE III-2 to IV]

OTHER SPECIFIC SCENARIOS

CPR in the prone position

Victims requiring chest compressions should be placed supine on a firm surface. Six case series that included 22 intubated hospitalised patients documented survival to hospital discharge in 10 patients who received CPR in the prone position.[18]

Recommendation

CPR with the patient prone is a reasonable alternative for intubated hospitalised patients who cannot be placed in the supine position. [Class B; LOE IV]

Ventilation rates after return of spontaneous circulation

The requirements for alveolar (minute) ventilation after return of spontaneous circulation depend on the specific circumstances. As with no cardiac output, in situations of limited cardiac output the requirements for ventilation will also be reduced. Higher ventilatory rates, with increases in intrathoracic pressure, can still decrease venous return and cardiac output.

Recommendation

After return of spontaneous circulation it is reasonable to use a ventilation rate of approximately 12/min until blood gas confirmation of $PaCO_2$ is available [Class B; LOE Exert Consensus Opinion].

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FURTHER READING

ARC Guideline 8 Cardiopulmonary Resuscitation
ARC Guideline 11.4 Electrical Therapy for Adult Advanced Life Support