Guideline 11.6.1 – Targeted Oxygen Therapy in Adult Advanced Life Support

Summary

This guideline provides advice on the administration of oxygen in the peri-arrest period.

Who does this guideline apply to?

This guideline applies to adults who require advanced life support.

Who is the audience for this guideline?

This guideline is for health professionals and those who provide healthcare in environments where equipment and drugs are available.

Recommendations

The Australian and New Zealand Committee on Resuscitation (ANZCOR) make the following recommendations:

1. Oxygen therapy should only be used by personnel trained in its use, and its effects should be monitored whenever possible, usually by the use of pulse oximetry.
2. In patients requiring advanced life support, oxygen should be administered if the oxygen saturation (SpO_2) falls below 94% unless contraindications exist.
3. ANZCOR recommends the use of 100% oxygen during adult cardiac arrest.
4. ANZCOR recommends avoiding hypoxia in adults with ROSC after cardiac arrest in any setting.
5. ANZCOR suggests avoiding hyperoxia in adults with ROSC after cardiac arrest in any setting.
6. Once ROSC has been established and the oxygen saturation of arterial blood (SaO2) can be monitored reliably (by pulse oximetry [SpO2] and/or arterial blood gas analysis [SaO2]), it is reasonable to titrate the inspired oxygen to achieve a target saturation between 94 – 98%.
7. In patients with suspected or proven acute coronary syndromes, the routine use of supplemental oxygen is not recommended.
8. Oxygen therapy is indicated for patients with suspected or proven acute coronary syndromes, with hypoxia and those with evidence of shock, to correct tissue hypoxia. It is

recommended that oxygen administration be targeted to achieve oxygen saturation (SpO_2) of 94-98%

9. In patients with suspected or proven acute coronary syndromes and the absence of hypoxia, the benefit of oxygen therapy is uncertain, and in some cases oxygen therapy may be harmful.
10. Patients who have experienced an acute stroke and are hypoxic should be given supplemental oxygen. It is recommended that oxygen administration be targeted to achieve oxygen saturation (SpO_2) of 94-98%.
11. The routine use of supplemental oxygen is not recommended in acute stroke patients who are not hypoxic.
12. All patients with shock, major trauma, sepsis or other critical illness should be managed initially with high concentration oxygen therapy from a reservoir mask. It is recommended that oxygen administration be targeted to achieve an oxygen saturation (SpO_2) of 94-98%.
13. The routine use of supplemental oxygen high-dose oxygen via a reservoir mask is recommended for a patient with carbon monoxide poisoning.
14. Patients developing symptoms of decompression sickness after diving should be treated with high flow oxygen as soon as possible.
15. In patients with Paraquat poisoning or bleomycin lung injury the routine use of supplemental oxygen is not recommended.
16. In patients with Paraquat poisoning or bleomycin lung injury it is recommended that oxygen administration be targeted to achieve oxygen saturation (SpO_2) of 88-92%.
17. In patients who are at risk of hypercapnic respiratory failure, the routine use of supplemental oxygen is not recommended.
18. In patients who are at risk of hypercapnic respiratory failure it is recommended that oxygen administration be targeted to achieve oxygen saturation (SpO_2) of 88-92%.

Guideline

The use of high concentrations of inspired oxygen has been routine during Advanced Life Support. The use of supplemental oxygen is not without risk, and its routine use has been questioned. Oxygen therapy should only be used by personnel trained in its use, and its effects should be monitored whenever possible, usually by the use of pulse oximetry. The pulse oximeter usually reads within ± 2%, but is less accurate in some specific situations (including poor perfusion, carbon monoxide toxicity etc).[1,2]

Adverse effects of the administration of oxygen include: worsened ventilation/perfusion matching; absorption atelectasis; myocardial ischaemia; reduced cardiac output; reduced coronary, cerebral and renal blood flow; increased peripheral resistance and blood pressure; and increased reactive oxygen species.[2]

Of particular concern in the peri-arrest period is the concern about increased oxidative damage, increased neuronal death, and worse neurologic function.[3,4]

Recommendations

Oxygen therapy should only be used by personnel trained in its use, and its effects should be monitored whenever possible, usually by the use of pulse oximetry. [Class A; Expert consensus opinion]

In patients requiring advanced life support, oxygen should be administered if the oxygen saturation (SpO_2) falls below 94% unless contraindications exist. [Class A; Expert consensus opinion]

1.0 | Oxygen Use During Cardiac Arrest

There were no adult (>8 years of age) human studies that addressed directly whether titrated oxygen compared with 100% oxygen during CPR affects outcome. Two animal studies that used a fibrillatory model of cardiac arrest suggested that use of 100% oxygen during CPR and for 15–60 min after ROSC results in worse neurological outcomes compared with normoxic (21% oxygen, room air) resuscitation, whereas one animal study using an asphyxial model documented that ventilation with either 100% oxygen or 21% oxygen during resuscitation did not affect outcome.[5]

A recent publication observed an association between improved oxygenation during cardiac arrest and improved rates of hospital admission.[6]

ANZCOR recommends the use of 100% oxygen during adult cardiac arrest (CoSTR 2015, weak recommendation, very low quality evidence). [7]

2.0 | Oxygen Use after Return of Spontaneous Circulation (ROSC)

After ROSC, toxic oxygen byproducts (reactive oxygen species, free radicals) are produced that may damage cell membranes, proteins, and DNA (reperfusion injury).

A number of animals studies have suggested that significant harm may result from the use of high concentrations of oxygen in the early resuscitation period.[3,5]

One randomised prospective clinical trial in patients who had been resuscitated from a cardiac arrest compared ventilation with 30% oxygen or 100% oxygen for the first 60 min after ROSC. Mean partial pressure of oxygen in arterial blood (PaO2) at 60min after ROSC was 110 ± 25 mmHg in the 30% oxygen group and 343 ± 174mmHg in the 100% oxygen group. No statistical difference was detected in serum biomarkers of acute brain injury, survival to hospital discharge, or the percent of patients with good neurological outcome (cerebral performance category of 1 or 2) at hospital discharge. However, this study was not adequately powered to detect important differences in survival and cerebral performance category at hospital discharge (n = 14 per group). A significant subset of patients in this study (30%) who were ventilated with 30% oxygen after ROSC required increased FiO2 to maintain a pulse oximetry reading of >95%. The study was underpowered to determine efficacy or harm. [8]

The results of recently published large observational studies which assessed the association between hyperoxia (utilising a number of ways of defining hyperoxia) after ROSC and in-hospital mortality in humans have been inconsistent and conflicting.[9-15]

Recommendations

ANZCOR recommends avoiding hypoxia in adults with ROSC after cardiac arrest in any setting (CoSTR 2015, strong recommendation, very low quality evidence).[7]

ANZCOR suggests avoiding hyperoxia in adults with ROSC after cardiac arrest in any setting (CoSTR 2015, weak recommendation, very low quality evidence).[7]

Once ROSC has been established and the oxygen saturation of arterial blood (SaO2) can be monitored reliably (by pulse oximetry [SpO2] and/or arterial blood gas analysis [SaO2]), it is reasonable to titrate the inspired oxygen to achieve a target saturation between 94 – 98%. [Class A; LOE III-2, Expert consensus opinion]

3.0 | Oxygen use in other specific scenarios

3.1 | Acute Coronary Syndromes (also see Guideline 14.2)

The routine use of supplemental oxygen is not recommended. Supplemental oxygen should be initiated if the patient has breathlessness, hypoxaemia and signs of heart failure or shock.[16] There is relatively limited evidence from clinical studies to support the routine use of oxygen therapy in ACS.[17] The use of oxygen saturation monitoring by non-invasive techniques such as pulse oximetry, may be very useful in guiding oxygen therapy.[18] However it is important to understand that hyperoxaemia may be potentially harmful in uncomplicated myocardial infarction.[16,19]

Recommendations

In patients with suspected or proven acute coronary syndromes, the routine use of supplemental oxygen is not recommended. [Class A; Expert consensus opinion]

Oxygen therapy is indicated for patients with hypoxia and those with evidence of shock, to correct tissue hypoxia. It is recommended that oxygen administration be targeted to achieve oxygen saturation (SpO_2) of 94-98%. [Class A; Expert consensus opinion]

In the absence of hypoxia, the benefit of oxygen therapy is uncertain, and in some cases oxygen therapy may be harmful. [Class A; Expert consensus opinion]

3.2 | Stroke

The use of oxygen in acute stroke is still controversial, and evidence is still being collected.[20] The routine use of supplemental oxygen is not recommended in acute stroke patients who are not hypoxic. Patients with oxygen saturation <95% should be given supplemental oxygen.[21]

Recommendations

Patients who have experienced an acute stroke and are hypoxic should be given supplemental oxygen. It is recommended that oxygen administration be targeted to achieve oxygen saturation (SpO_2) of 94-98%. [Class A; Expert consensus opinion]

The routine use of supplemental oxygen is not recommended in acute stroke patients who are not hypoxic. [Class A; Expert consensus opinion]

3.3 | Other critical illnesses

Treatment recommendation:

All patients with shock, major trauma, sepsis or other critical illness should be managed initially with high concentration oxygen therapy from a reservoir mask. It is recommended that oxygen administration be targeted to achieve an oxygen saturation (SpO_2) of 94-98%. [2] [Class A; Expert consensus opinion]

4.0 | Oxygen Use in Other Specific Scenarios: High Oxygen Goals

4.1 | Carbon monoxide poisoning

The most important treatment for a patient with carbon monoxide poisoning is to give high-dose oxygen via a reservoir mask. Pulse oximetry cannot screen for carbon monoxide exposure as it does not differentiate carboxyhaemoglobin from oxyhaemoglobin. The blood carboxyhaemoglobin level must be measured to assess the degree of carbon monoxide poisoning.[2]

Recommendations

The routine use of supplemental oxygen high-dose oxygen via a reservoir mask is recommended for a patient with carbon monoxide poisoning. [Class A; Expert consensus opinion]

4.2 | Diving emergencies

Musculoskeletal or neurologic symptoms occuring soon after diving may be signs of decompression sickness and should be treated with high flow oxygen as soon as possible.[22,23]

Recommendations

Patients developing symptoms of decompression sickness after diving should be treated with high flow oxygen as soon as possible. [Class A; Expert consensus opinion]

5.0 | Oxygen Use in Specific Scenarios: Lower Oxygen Goals

5.1 | Paraquat poisoning and bleomycin lung injury

Oxygen is known to be hazardous to patients with paraquat poisoning. Oxygen worsens bleomycin lung injury. Because of these risks, supplemental oxygen should be given to patients with these conditions only if needed, aiming for a target range of saturation (SpO_2) of 88–92%.[2]

Recommendations

In patients with Paraquat poisoning or bleomycin lung injury the routine use of supplemental oxygen is not recommended. [Class A; Expert consensus opinion]

It is recommended that oxygen administration be targeted to achieve oxygen saturation (SpO_2) of 88-92%. [Class A; Expert consensus opinion]

5.2 | Patients at risk of hypercapnic respiratory failure

Uncontrolled supplemental oxygen therapy can be harmful to patients who are at risk of hypercapnic respiratory failure. If high concentrations of oxygen are given to these patients, the oxygen level in the blood will rise but the level of carbon dioxide will also rise and this can cause acidosis with subsequent organ dysfunction and, when severe, coma. The target SpO2 is 88–92% if the patient is at risk of hypercapnic respiratory failure.

A small reduction in ventilation may be a contributing factor to the rise in carbon dioxide levels during oxygen therapy in COPD. Much of the rise in carbon dioxide which occurs is due to deterioration in the matching of blood flow and gas flow in the lungs.[2] This can be avoided by giving controlled lower concentration oxygen therapy to vulnerable patients.

It is not possible to predict if individual patients with COPD will develop hypercapnia during an acute exacerbation, so all patients with moderate or severe COPD should be considered to be at risk of this complication until the results of blood gas measurements are available.

If the diagnosis is unknown, patients aged >50 years who are long-term smokers with a history of chronic breathlessness on minor exertion such as walking on level ground and no other known cause of breathlessness should be treated as if having COPD. Patients without diagnosed COPD, but at risk of hypercapnic respiratory failure include patients with:

- cystic fibrosis

- bronchiectasis
- severe kyphoscoliosis or severe ankylosing spondylitis
- severe lung scarring from old tuberculosis (especially with thoracoplasty)
- morbid obesity (body mass index >40 kg/m2)
- musculoskeletal disorders with respiratory muscle weakness (especially if on home ventilation)
- overdose of opioids, benzodiazepines or other respiratory depressant drugs.

Recommendations

In patients who are at risk of hypercapnic respiratory failure, the routine use of supplemental oxygen is not recommended. [Class A; Expert consensus opinion]

In these patients, it is recommended that oxygen administration be targeted to achieve oxygen saturation (SpO_2) of 88-92%. [Class A; Expert consensus opinion]

References

1. Lee WW, Mayberry K, Crapo R, Jensen RL. The accuracy of pulse oximetry in the emergency department. The American Journal of Emergency Medicine. 2000;18(4):427-31.
2. O'Driscoll BR, Howard LS, Davison AG. BTS guideline for emergency oxygen use in adult patients. Thorax. 2008 Oct;63 Suppl 6:vi1-68
3. Neumar RW. Optimal oxygenation during and after cardiopulmonary resuscitation. Curr Opin Crit Care. 2011 Jun;17(3):236-40.
4. Pilcher, J., M. Weatherall, et al. (2012). "The effect of hyperoxia following cardiac arrest - A systematic review and meta-analysis of animal trials." Resuscitation 83(4): 417-422
5. Deakin CD, Morrison LJ, Morley PT, Callaway CW, Kerber RE, Kronick SL, et al. Part 8: Advanced life support: 2010 International Consensus on Cardiopulmonary Resuscitation and Emergency Cardiovascular Care Science with Treatment Recommendations. Resuscitation. [doi: DOI: 10.1016/j.resuscitation.2010.08.027]. 2010;81(1, Supplement 1):e93-e174.
6. Spindelboeck W. et al. Increasing arterial oxygen partial pressure during cardiopulmonary resuscitation is associated with improved rates of hospital admission 2013 84:6:770–775
7. Soar J, Callaway C, Aibiki M, Böttiger BW, Brooks SC, Deakin CD, Donnino MW, Drajer S, Kloeck W, Morley PT, Morrison LJ, Neumar RW, Nicholson TC, Nolan JP, Okada K, O'Neil BJ, Paiva EF, Parr MJ, Wang TL, Witt J, on behalf of the Advanced Life Support Chapter Collaborators. Part 4: Advanced life support. 2015 International Consensus on Cardiopulmonary Resuscitation and Emergency Cardiovascular Care Science with Treatment Recommendations. Resuscitation 2015;95:e71–e120
8. Kuisma M, Boyd J, Voipio V, Alaspaa A, Roine RO, Rosenberg P. Comparison of 30 and the 100% inspired oxygen concentrations during early post-resuscitation period: a randomised controlled pilot study. Resuscitation 2006;69:199–206.
9. Kilgannon JH, Jones AE, Parrillo JE, Dellinger RP, Milcarek B, Hunter K, et al. Relationship between supranormal oxygen tension and outcome after resuscitation from cardiac arrest. Circulation. 2011 Jun 14;123(23):2717-22.
10. Bellomo R, Bailey M, Eastwood GM, Nichol A, Pilcher D, Hart GK, et al. Arterial hyperoxia and in-hospital mortality after resuscitation from cardiac arrest. Crit Care. 2011;15(2):R90.
11. Janz, D. R., R. D. Hollenbeck, et al. (2012). "Hyperoxia is associated with increased mortality in patients treated with mild therapeutic hypothermia after sudden cardiac

arrest." Crit Care Med 40(12): 3135-3139.
12. Ihle, J. F., S. Bernard, et al. (2013). "Hyperoxia in the intensive care unit and outcome after out-of-hospital ventricular fibrillation cardiac arrest." Crit Care Resusc 15(3): 186-190.
13. Nelskyla, A., M. J. Parr, et al. (2013). "Prevalence and factors correlating with hyperoxia exposure following cardiac arrest -- an observational single centre study." Scand J Trauma Resusc Emerg Med 21(1): 35.
14. Roberts BW, Kilgannon JH, Chansky ME, Mittal N, Wooden J, Trzeciak S. Association between postresuscitation partial pressure of arterial carbon dioxide and neurological outcome in patients with post-cardiac arrest syndrome. *Circulation*. 2013;127:2107-2113.
15. Elmer J, Scutella M, Pullalarevu R, Wang B, Vaghasia N, Trzeciak S, Rosario-Rivera BL, Guyette FX, Rittenberger JC, Dezfulian C, Pittsburgh Post-Cardiac Arrest S. The association between hyperoxia and patient outcomes after cardiac arrest: analysis of a high-resolution database. *Intensive Care Med*. 2015;41:49-57
16. Cabello JB, Burls A, Emparanza JI, Bayliss S, Quinn T. Oxygen therapy for acute myocardial infarction. Cochrane Database Syst Rev 2010 (6):CD007160.
17. Chew DP et al. 2011 Addendum to the National Heart Foundation of Australia/Cardiac Society of Australia and New Zealand Guidelines for the Management of Acute Coronary Syndromes (ACS) 2006 Heart Lung and Circulation. 2011;20:487–502
18. Wilson AT, Channer KS. Hypoxaemia and supplemental oxygen therapy in the first 24 hours after myocardial infarction: the role of pulse oximetry. J R Coll Physicians Lond 1997;31(6):657-61.
19. Rawles JM, Kenmure AC. Controlled trial of oxygen in uncomplicated myocardial infarction. Br Med J 1976;1(6018):1121-23.
20. Pountain SJ, Roffe C. Does routine oxygen supplementation in patients with acute stroke improve outcome? BMJ 2012;345:e6976
21. Stroke Foundation Clinical Guidelines at: https://strokefoundation.com.au/~/media/strokewebsite/resources/treatment/clinical_guidelines_acute_management_recommendations_2010.ashx?la=en (accessed November 2015)
22. DeGorordo A, Vallejo-Manzur F, Chanin K, Varon J. Diving emergencies. Resuscitation. 2003;59(2):171-80.
23. Longphre JM et al. First aid normobaric oxygen for the treatment of recreational diving injuries. UHM 2007, Vol. 34, No. 1

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