CPR: Compression to Ventilation Ratio-Bystander – Adult

Citation

Olasgavengen T, Mancini MB, Berg, RA, Brooks S, Castren M, Chung SP, Considine J, Escalante R, Gazmuri R, Hatanaka T, Koster R, Kudenchuk P, Lim SH, Lofgren B, Nation, K, Nishiyma C, Perkins GD, Ristagno G, Sakamoto T, Sayre, M, Sierra A, Smyth M, Stanton D, Travers A, Valliancourt C, Morley, JP, Nolan, J. CPR : Chest Compression to Ventilation Ratio-Bystander- Adult Consensus on Science and Treatment Recommendation [Internet]. Brussels, Belgium: International Liaison Committee on Resuscitation (ILCOR), Basic Life Support Task Force, 2017 July 30. Available from: http://www.ilcor.org

CPR: Compression to Ventilation PICOST

The PICOST (Population, Intervention, Comparator, Outcome, Study Designs and Timeframe)
Population: Patients of all ages (i.e., neonates, children, adults) with cardiac arrest from any cause and across all settings (in-hospital and outof-hospital). Studies that included animals were not eligible. Intervention: All manual CPR methods including Compression-only CPR (CO-CPR), Continuous Compression CPR (CC-CPR), and CPR with different compression-to-ventilation ratios. CO-CPR included compression with no ventilations, while CC-CPR included compression with asynchronous ventilations or minimally-interrupted cardiac resuscitation (MICR) Studies that mentioned the use of a mechanical device during CPR were only considered if the same device was used across all relevant intervention arms and would therefore not confound the observed effect.
Comparators: Studies had to compare at least two different CPR methods from the eligible interventions; studies without a comparator were excluded.
Outcomes: The primary outcome was favorable neurological outcomes, measured by cerebral performance or a modified Rankin Score. Secondary outcomes were survival, ROSC, and quality of life.
Study designs: Randomised controlled trials (RCTs) and non-randomised studies (non-randomised controlled trials, interrupted time series, controlled before-and-after studies, cohort studies) were eligible for inclusion. Study designs without a comparator group (e.g., case series, cross-sectional studies), reviews, and pooled analyses were excluded.
Timeframe: Published studies in English searched on January 15, 2016

For the critical outcome of favorable neurological function, we identified very low quality evidence from six cohort studies (SOS-KANTO 2007 920, Olasveengen 2008 914, Ong 2008 119, Bobrow 2010 1447, Panchal 2013 435, Iwami 2015 415). In a meta-analysis of two studies (SOS-KANTO 2007 920, Ong 2008 119) patients who received continuous chest compressions had a no demonstrable benefit for favorable neurological function (RR 1.34 (0.82, 2.20); RD 0.51 (-2.16, 3.18)) when compared to compression to ventilation ratio 15:2. The quality of evidence was downgraded for serious indirectness and imprecision. A further study from Japan (Iwami 2015 415) examined the influence of a nationwide dissemination of continuous chest compression recommendations for lay-rescuers including dispatcher-assisted resuscitation at a time where conventional CPR guidelines recommended 30 compressions to 2 ventilations. The unadjusted analysis of crude data dissemination of continuous chest compression

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recommendations in dispatch and for bystanders was associated with improved bystander CPR rates and nationwide survival, but outcomes amongst patients receiving continuous chest compressions were worse compared with those receiving conventional CPR (RR 0.72 (0.69, 0.76); RD 0.48 (0.43, 0.54). The level of evidence was downgraded for serious indirectness. In a meta-analysis of three studies (Olasveengen 2008 914, Bobrow 2010 1447, Panchal 2013 435) patients who received continuous chest compressions no demonstrable benefit for favorable neurological function (RR 1.12 (0.71, 1.77); RD 0.28 (-2.33, 2.89)) when compared to standard CPR in a period where compression to ventilation ratio changed from 15:2 to 30:2. The quality of evidence was downgraded for serious indirectness and imprecision.

For the critical outcome of survival, we identified very low quality evidence from seven cohort studies (Holmberg 2001 511, Waalewijin 2001 273, Bohm 2007 2908, Iwami 2007 2900, SOS-KANTO 2007 920, Ong 2008 119, Iwami 2015 415). In a meta-analysis of six studies (Holmberg 2001 511, Waalewijin 2001 273, Bohm 2007 2908, Iwami 2007 2900, SOS-KANTO 2007 920, Ong 2008 119) patients who received continuous chest compressions had no demonstrable benefit for survival (RR 0.88 (0.74, 1.04); RD -0.83 (-1.85, 0.19)) when compared to those who received compressions and ventilations at a time when the compression to ventilation ratio was 15:2. The quality of evidence was downgraded for serious risk of bias and indirectness. In unadjusted analysis of crude data in the study from Japan (Iwami 2015 415) patients receiving continuous chest compressions had worse survival (RR 0.75 (0.73, 0.78); RD -1.42 (-1.58, -1.25)) when compared to those receiving conventional CPR with 30 compressions to 2 ventilations. The quality of evidence was downgraded for serious indirectness. In a meta-analysis of three observational studies (Olasveengen 2008 914, Bobrow 2010 1447, Panchal 2013 435) patients who received continuous chest compressions had no demonstrable benefit for survival (RR 1.16 (0.64, 2.09); 1.27 (-3.70, 6.23)) when compared to those who received compressions and ventilations during a period when the compression to ventilation ratio changed from 15:2 to 30:2. The quality of evidence was downgraded for serious inconsistency, indirectness and imprecision.

For the critical outcome of return of spontaneous circulation, we identified very low quality evidence from four cohort studies (Van Hoeyweghen 1993 47, Iwami 2007 2900, Ong 2008 119, Iwami 2015 415). In a meta-analysis of three studies (Van Hoeyweghen 1993 47, Iwami 2007 2900, Ong 2008 119) patients who received continuous chest compressions had no demonstrable benefit for ROSC (RR 0.89 (0.68, 1.16); RD -4.19 (-13.68, 5.31)) when compared to those who received compressions and ventilations at a time when the compression to ventilation ratio was 15:2. The quality of evidence was downgraded for serious risk of bias, inconsistency, indirectness, and imprecision. In unadjusted analysis of crude data from the study from Japan (Iwami 2015 415) patients receiving continuous chest compressions has worse return of spontaneous circulation (RR 0.80 (0.78, 0.82); RD -1.62 (-1.81, -1.42)) when compared to those who received conventional CPR with 30 compressions to 2 ventilations. In unadjusted analysis of crude data from one study (Olasveengen 2008 914) patients who received continuous chest compressions had no demonstrable benefit for ROSC (RR 0.98 (0.75, 1.27); RD -0.81 (-10.48, 8.85)) compared to those who received compressions and ventilations during a period when the compression to ventilation ratio changed from 15:2 to 30:2. The

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quality of evidence was downgraded for serious indirectness.

Treatment recommendations
We continue to recommend that chest compressions be performed for all patients in cardiac arrest (good practice statement). In the 2015 CoSTR, this was cited as a strong recommendation but based on very-low-quality evidence. (Perkins 2015 e43, Travers 2015 s51) We suggest that those who are trained, able and willing to give rescue breaths as well as chest compressions do so for all adult patients in cardiac arrest (weak recommendation, very-low-quality evidence).

Values and Preferences
In making these recommendations, the task force strongly endorsed the 2010 and 2015 ILCOR Consensus on Science that all rescuers should perform chest compressions for all patients in cardiac arrest. The task force draws attention to the potential gains from the simplicity of teaching compression-only CPR and given that there appears to be no downside in true arrest patients. The task force further acknowledges the potential additional benefits of conventional CPR when delivered by trained laypersons, particularly in settings where EMS response intervals are long and for asphyxial causes of cardiac arrest. The task force noted clinical and statistical heterogeneity in several of the studies pooled for meta-analysis. The strength of the final treatment recommendation reflects consideration of this heterogeneity, the quality of index studies and the task force overall synthesis and interpretation of the presented evidence.

Knowledge gaps
Current knowledge gaps include but are not limited to:
- The effect of delayed ventilation versus 30:2 high-quality CPR.
- The ability of bystanders to perform correct mouth-to-mouth ventilations.
- The effect of hyperventilation on circulation during chest compressions.
- The effect of hyperventilation on outcomes for cardiac arrest patients.
- Effects of ventilation attempts during a closed airway, effects of gastric insufflation.
- The duration of maximum delay in positive-pressure ventilation.
- Is there a critical volume of air movement required to maintain effectiveness?
- How effective is passive insufflation?
- The impact continuous chest compressions on outcomes for non-cardiac etiology arrests such as drowning, trauma, asphyxia in adult and pediatric patients?

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