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| Question | |
| **Should minimization of pauses in chest compressions (higher CPR fraction and shorter peri-shock pause compared to control) vs. standard CPR (lower CPR fraction and longer peri-shock pause compared to intervention) be used for adult patients in cardiac arrest?** | |
| **Population:** | Adults and children receiving manual CPR following out-of-hospital cardiac arrest |
| **Intervention:** | Transport with ongoing manual CPR |
| **Comparison:** | Completing manual CPR on scene |
| **Main outcomes:** | Quality of CPR metrics (outcomes may include rate of chest compressions, depth of chest compressions, chest compression fraction, interruptions to chest compressions, leaning/incomplete release, rate of ventilation, volume of ventilation, duration of ventilation, pressure of ventilation) |
| **Setting:** | out-of-hospital |
| **Perspective:** |  |
| **Background:** | Poor quality CPR may adversely impact survival outcomes in cardiac arrest. Provision of high-quality CPR is challenging, especially in a moving ambulance. If CPR quality is lower during ambulance transport it may be appropriate to advocate that EMS remain on scene and focus upon delivery of high-quality CPR. |
| **Conflict of interests:** |  |

# Assessment

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| --- | --- | --- |
| Problem Is the problem a priority? | | |
| Judgement | Research evidence | Additional considerations |
| ○ No ○ Probably no x Probably yes ○ Yes ○ Varies ○ Don't know | The cornerstone of high-quality CPR comprises delivery of chest compressions at a rate of 100-120 compression per minute, to a depth of 50-60mm, while allowing full recoil of the chest between compressions. Interruptions should be minimized and should not exceed 10 seconds. Defibrillation should occur as soon as a defibrillator is available and then at 2-minute intervals thereafter if still appropriate.  If EMS crews will initiate resuscitation at the scene of cardiac arrest. If they fail to achieve ROSC they must either terminate resuscitation on scene or transport the patient to hospital with ongoing CPR  Transport with ongoing CPR may be problematic for the following reasons:   1. Extrication from the scene of the cardiac arrest, to the ambulance, results in interruptions to CPR and reduces quality of CPR. This may adversely impact the likelihood of achieving ROSC 2. There is limited evidence to suggest quality of manual CPR may be reduced during ambulance transport which may adversely impact the likelihood of achieving ROSC. 3. EMS providers are at increased risk of injury during transport in the event of a collision if standing unrestrained while performing CPR. 4. In many modern EMS systems, the interventions provided on scene by EMS crews are now the same as are routinely provided in the emergency department. As such there may be no additional benefit to transporting the patient to hospital. 5. Most patients transported to hospital will have received resuscitation on scene for a number of minutes. The likelihood of survival from cardiac arrest reduces with increasing resuscitation duration. Most patients transported to hospital following unsuccessful scene resuscitation will have lower than average likelihood of survival. | When EMS cannot provide interventions that may be beneficial to the victim of cardiac arrest, e.g. ECMO or resuscitative hysterotomy, then the potential benefits of those interventions may outweigh the risks associated with transport. |
| Desirable Effects How substantial are the desirable anticipated effects? | | |
| Judgement | Research evidence | Additional considerations |
| ○ Trivial ○ Small x Moderate ○ Large ○ Varies ○ Don't know | There is limited evidence to suggest that survival is improved by continuing resuscitation at scene rather than transporting to hospital. Grunau et al (2020) reported that survival to hospital discharge was 3.8% for patients who underwent intra-arrest transport and 12.6% for those who received on-scene resuscitation. In a propensity-matched cohort, survival to hospital discharge occurred in 4.0% of patients who underwent intra-arrest transport vs 8.5% who received on-scene resuscitation (risk difference, 4.6% [95% CI, 4.0%- 5.1%]). Favorable neurological outcome occurred in 2.9% of patients who underwent intra-arrest transport vs 7.1% who received on-scene resuscitation (risk difference, 4.2% [95% CI, 3.5%-4.9%]).  Quality of CPR will be higher if resuscitation is carried out at scene as it avoids the need to extricate from scene to ambulance, leading to fewer interruptions to CPR. Evidence suggests quality of manual CPR is higher on scene than during transport. Higher quality resuscitation at scene may improve the likelihood of achieving ROSC.  The risk of injury to EMS providers (and other road users) as a result of vehicle collision is avoided.  In some systems, termination of resuscitation on scene when ROSC is not achieved, may help minimize the financial liability associated with futile care.  Fewer patients being transported to hospital will help reduce the burden on limited health care resources | The data are uncertain with no randomized controlled trials studies directly evaluating the question. |
| Undesirable Effects How substantial are the undesirable anticipated effects? | | |
| Judgement | Research evidence | Additional considerations |
| ○ Large ○ Moderate x Small ○ Trivial ○ Varies ○ Don't know | Some victims of cardiac arrest may benefit from interventions that cannot be provided by EMS crews, but that are available at hospital. For example ECMO, resuscitative hysterotomy  Relatives of victims of cardiac arrest may feel their loved one was disadvantaged by not being taken to hospital for further care.  There may be costs associated with termination of resuscitation on scene (e.g. EMS crews delayed on scene waiting for police or doctor) | Resuscitation guidelines could address which patient groups are likely to benefit from transport where the risk/benefit balance favours transport |
| Certainty of evidence What is the overall certainty of the evidence of effects? | | |
| Judgement | Research evidence | Additional considerations |
| x Very low ○ Low ○ Moderate ○ High ○ No included studies | The overall certainty of evidence is VERY LOW. The majority of included studies had a high risk of bias. There are also problems with indirectness and generalizability as much of the evidence arises from manikin studies or from high performance EMS systems. |  |
| Values Is there important uncertainty about or variability in how much people value the main outcomes? | | |
| Judgement | Research evidence | Additional considerations |
| ○ Important uncertainty or variability x Possibly important uncertainty or variability ○ Probably no important uncertainty or variability ○ No important uncertainty or variability | With reference to the guidance provided by the COSCA initiative ("Core Outcome Set for Cardiac Arrest" - a partnership between patients, their partners, clinicians, research scientists, and the International Liaison Committee on Resuscitation, sought to develop a consensus core outcome set for cardiac arrest for effectiveness trials), there is no important uncertainty about how much people would value favourable survival or survival as an outcome.  However, it is not certain that potential survivors would not be missed by advocating to continue resuscitation on scene rather that to initiate transport with CPR | Haywood K, Whitehead L, Nadkarni VM, Achana F, Beesems S, Böttiger BW, Brooks A, Castrén M, Ong MEH, Hazinski MF, Koster RW, Lilja G, Long J, Monsieurs KG, Morley PT, Morrison L, Nichol G, Oriolo V, Saposnik G, Smyth M, Spearpoint K, Williams B, Perkins GD; COSCA Collaborators. COSCA (Core Outcome Set for Cardiac Arrest) in Adults: An Advisory Statement From the International Liaison Committee on Resuscitation. Resuscitation. 2018 Jun;127:147-163. doi: 10.1016/j.resuscitation.2018.03.022.  There may be cultural barriers to EMS stopping resuscitation.  There may be legal barriers to non-medical personnel stopping resuscitation. |
| Balance of effects Does the balance between desirable and undesirable effects favor the intervention or the comparison? | | |
| Judgement | Research evidence | Additional considerations |
| ○ Favors the comparison ○ Probably favors the comparison ○ Does not favor either the intervention or the comparison ○ Probably favors the intervention ○ Favors the intervention ○ Varies x Don't know | As both desirable and undesirable effects are very uncertain. |  |
| Resources required How large are the resource requirements (costs)? | | |
| Judgement | Research evidence | Additional considerations |
| ○ Large costs ○ Moderate costs ○ Negligible costs and savings x Moderate savings ○ Large savings ○ Varies ○ Don't know | The overall cost or need for resources to implement the intervention is likely to be reduced. Resources needed at scene are likely to remain the same.  There may be costs associated with education and training for EMS crews with respect to termination of resuscitation decisions and pastoral support of bereaved relatives.  If fewer patients are transport there will be lower use of limited emergency department resource. | If legal barriers to stopping resuscitation exist there may be considerable political challenge to implement |
| Certainty of evidence of required resources What is the certainty of the evidence of resource requirements (costs)? | | |
| Judgement | Research evidence | Additional considerations |
| ○ Very low ○ Low ○ Moderate ○ High x No included studies | There is no evidence of increased need for physical resources. There may be an increase in educational costs to prepare EMS crews to widen their scope for termination of resuscitation. |  |
| Cost effectiveness Does the cost-effectiveness of the intervention favor the intervention or the comparison? | | |
| Judgement | Research evidence | Additional considerations |
| ○ Favors the comparison ○ Probably favors the comparison ○ Does not favor either the intervention or the comparison x Probably favors the intervention ○ Favors the intervention ○ Varies ○ No included studies | There is no evidence to indicate resuscitation at scene is more cost effective that transporting to hospital. There is indirect evidence to suggest that very few patients who are transported with CPR in progress survive.  Drennan IR, Lin S, Sidalak DE, Morrison LJ. Survival rates in out-of-hospital cardiac arrest patients transported without prehospital return of spontaneous circulation: an observational cohort study. Resuscitation. 2014 Nov 1;85(11):1488-93.  Of 3374 patients transported to hospital who did not meet termination of resuscitation criteria only 122 (3.6%) survived. Continuing resuscitation at scene and terminating those who did not respond to further resuscitation may significantly reduce the number of cases transported and ease the burden on scarce ED resources. |  |
| Equity What would be the impact on health equity? | | |
| Judgement | Research evidence | Additional considerations |
| ○ Reduced ○ Probably reduced ○ Probably no impact ○ Probably increased ○ Increased ○ Varies x Don't know | The wider costs of delivering CPR on scene are uncertain, there is little to inform potential impact on health equity. Extending the delivery of resuscitation on scene will require resources for training and education. It is unlikely the requirements surpass the resources systems already have in place for continued education and training. If increasing on scene resuscitation reduces the number of patients transported for ECMO or other similar advanced interventions, there could potentially be a negative impact on health equity. |  |
| Acceptability Is the intervention acceptable to key stakeholders? | | |
| Judgement | Research evidence | Additional considerations |
| ○ No ○ Probably no x Probably yes ○ Yes ○ Varies ○ Don't know | There is limited evidence to suggest that patient outcomes are improved by providing resuscitation at scene rather than transporting. There is general consensus within the resuscitation community is that high quality CPR is important for patient outcomes. There is limited evidence to suggest that quality of CPR is lower during ambulance transport. There is limited evidence to suggest that survival is lower for patients transported rather than resuscitated at scene. There is limited evidence to suggest that survival is low for patients transported with CPR. | There may be cultural barriers to stopping resuscitation in some regions of the world |
| Feasibility Is the intervention feasible to implement? | | |
| Judgement | Research evidence | Additional considerations |
| ○ No ○ Probably no ○ Probably yes x Yes ○ Varies ○ Don't know | Current guidelines highlight the importance of high-quality CPR. |  |

# Summary of judgements

|  | **Judgement** | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Problem** | No | Probably no | Probably yes | Yes |  | Varies | Don't know |
| **Desirable Effects** | Trivial | Small | Moderate | Large |  | Varies | Don't know |
| **Undesirable Effects** | Large | Moderate | Small | Trivial |  | Varies | Don't know |
| **Certainty of evidence** | Very low | Low | Moderate | High |  |  | No included studies |
| **Values** | Important uncertainty or variability | Possibly important uncertainty or variability | Probably no important uncertainty or variability | No important uncertainty or variability |  |  |  |
| **Balance of effects** | Favors the comparison | Probably favors the comparison | Does not favor either the intervention or the comparison | Probably favors the intervention | Favors the intervention | Varies | Don't know |
| **Resources required** | Large costs | Moderate costs | Negligible costs and savings | Moderate savings | Large savings | Varies | Don't know |
| **Certainty of evidence of required resources** | Very low | Low | Moderate | High |  |  | No included studies |
| **Cost effectiveness** | Favors the comparison | Probably favors the comparison | Does not favor either the intervention or the comparison | Probably favors the intervention | Favors the intervention | Varies | No included studies |
| **Equity** | Reduced | Probably reduced | Probably no impact | Probably increased | Increased | Varies | Don't know |
| **Acceptability** | No | Probably no | Probably yes | Yes |  | Varies | Don't know |
| **Feasibility** | No | Probably no | Probably yes | Yes |  | Varies | Don't know |

# Type of recommendation

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Strong recommendation against the intervention | Conditional recommendation against the intervention | Conditional recommendation for either the intervention or the comparison | Conditional recommendation for the intervention | Strong recommendation for the intervention |
| ○ | ○ | ○ | x | ○ |