

Letters to the Editor

Time to shock people

Andrew Taber et al. provide valuable insight into the significant challenges of resuscitation in the confines of a diving bell.^{1,2} We understand that their main objective is to compare effectiveness of manual CPR vs NUI compact chest compression device (NCCD) in prolonged resuscitation in a diving bell.¹ However, they miss a significant educational opportunity. In resuscitating a casualty from an out-of-hospital cardiac arrest (OHCA), there is no mention of the potential importance of early defibrillation. The authors advise readers that it may take 40 minutes to recover a diving bell. They advocate the use of the NUI compact chest compression device (NCCD), without warning of its limitations in this scenario, specifically that it may slow the progression to possible early defibrillation in the diving bell. Out-of-hospital cardiac arrest is arguably the most time critical, medical emergency. Cardiac arrest can generally be divided into shockable and non-shockable rhythms. The potential for survival from an OHCA non-shockable rhythm would be nigh on impossible to influence in a diving bell. Survival is much more likely from a shockable rhythm.³ Good quality, uninterrupted, chest compression is critical, however defibrillation is arguably the vital step to achieving the return to viable circulation in a shockable rhythm arrest. Defibrillation within 3–5 minutes of collapse can produce survival rates of up to 50%, potential survival decreases very rapidly, every one minute of delay to defibrillation reduces survival by ten percent.⁴

A review of 17,238 cases of OHCA indicated that the probability of one month survival with favourable neurological outcome falls to 0.4% with a CPR duration of 30 minutes; and declines even further after this period.⁵ Time constraints exist, for example, the diver's hot water suit needs removing, with safety harness left in place; of the thirteen saturation diving vessels that regularly operate in the UK sector of the North Sea, nine (70%) only have a bell 'bottom door' (no side door) meaning CPR must be interrupted, the casualty moved off the 'bottom door', to allow opening and to access the ships diving complex. Diving vessels that operate in the UK and Norwegian sector have defibrillators, either as customised static units, machine outside the chamber, paddles inside, or customised defibrillators in large pressure housings. Static defibrillators introduce further time constraints being located several interconnecting chambers away from the bell's point of connection, requiring the unconscious casualty to be transferred, whilst still being resuscitated. With slow compression, defibrillators tolerate the pressure changes seen in saturation diving bells. The need for safe defibrillation in a wet environment has long been recognised.⁶ Medical device regulatory authorities have standards such as ISO 13485 which outlines specified requirements for medical devices including automated

external defibrillator batteries. We contend that in an OHCA in a 'diving bell' without access to a defibrillator (within 10 but certainly 30 minutes) the chances of meaningful survival are the same 'with or without' NCCD. Resuscitation of an OHCA for greater than 30 minutes with repeated cessation to chest compression is questionably futile. If industry accepts divers are a population at risk, providing a defibrillator and safe protocols for its use in a diving bell are the key issue.

References

- 1 Tabner A, Bryson P, Tilbury N, McGregor B, Wesson A, Hughes GD, et al. An evaluation of the NUI Compact Chest Compression Device (NCCD), a mechanical CPR device suitable for use in the saturation diving environment. *Diving Hyperb Med.* 2023;53:181–8. doi: [10.28920/dhm53.3.181-188](https://doi.org/10.28920/dhm53.3.181-188). PMID: [37718291](https://pubmed.ncbi.nlm.nih.gov/37718291/). PMID: [PMC10597600](https://pubmed.ncbi.nlm.nih.gov/PMC10597600/).
- 2 Johnson G, Bryson P, Tilbury N, McGregor B, Wesson A, Hughes GD, et al. Delivering manual cardiopulmonary resuscitation (CPR) in a diving bell: an analysis of head-to-chest and knee-to-chest compression techniques. *Diving Hyperb Med.* 2023;53:172–80. doi: [10.28920/dhm53.3.172-180](https://doi.org/10.28920/dhm53.3.172-180). PMID: [37718290](https://pubmed.ncbi.nlm.nih.gov/37718290/). PMID: [PMC10597601](https://pubmed.ncbi.nlm.nih.gov/PMC10597601/).
- 3 Rajan S, Folke F, Møller Hansen S, Malta Hansen C, Kragholm K, Gerds TA, et al. Incidence and survival outcome according to heart rhythm during resuscitation attempt in out-of-hospital cardiac arrest patients with presumed cardiac aetiology. *Resuscitation.* 2017;114:157–63. doi: [10.1016/j.resuscitation.2016.12.021](https://doi.org/10.1016/j.resuscitation.2016.12.021). PMID: [28087286](https://pubmed.ncbi.nlm.nih.gov/28087286/).
- 4 Holmberg M, Holmberg S, Herlitz J. Incidence, duration and survival of ventricular fibrillation in out-of-hospital cardiac arrest patients in Sweden. *Resuscitation.* 2000;44:7–17. doi: [10.1016/s0300-9572\(99\)00155-0](https://doi.org/10.1016/s0300-9572(99)00155-0). PMID: [10699695](https://pubmed.ncbi.nlm.nih.gov/10699695/).
- 5 Goto Y, Funada A, Goto Y. Relationship between the duration of cardiopulmonary resuscitation and favourable neurological outcome after out-of-hospital cardiac arrest: A prospective nationwide population-based cohort study. *J Am Heart Assoc.* 2016; 5(3):e002819. doi: [10.1161/JAHA.115.002819](https://doi.org/10.1161/JAHA.115.002819). PMID: [26994129](https://pubmed.ncbi.nlm.nih.gov/26994129/). PMID: [PMC4943259](https://pubmed.ncbi.nlm.nih.gov/PMC4943259/).
- 6 DAN Divers Alert Network. Are AEDs safe in wet environments. 1 August 2014. [cited 2023 Oct 1]. Available from: <https://dan.org/alert-diver/article/are-aeds-safe-in-wet-environments/>.

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