



DOES MINIMALLY INTERRUPTED CARDIAC RESUSCITATION (MICR) IMPROVE OUTCOMES OF CARDIAC ARREST?

by *Herbert Patrick MD*

The peer-reviewed research article selected to teach the Scientific Method is: Bentley J. Bobrow, MD; Lani L. Clark, BS; Gordon A. Ewy, MD; Vatsal Chikani, MPH; Arthur B. Sanders, MD; Robert A. Berg, MD; Peter B. Richman, MD; Karl B. Kern, MD: Minimally Interrupted Cardiac Resuscitation by Emergency Medical Services for Out-of-Hospital Cardiac Arrest in the Journal of the American Medical Association (JAMA) issue of 12 March 2008; Volume 299, Number 10, pages 1158-1165. The authors are from the Department of Emergency Medicine, Mayo Clinic, Scottsdale (Drs Bobrow and Richman), Arizona Department of Health Services, Bureau of Emergency Medical Services and Trauma System, Phoenix (Dr Bobrow and Mss Clark and Chikani), Sarver Heart Center, University of Arizona College of Medicine, Tucson (Drs Bobrow, Ewy, Sanders, Berg, and Kern, and Ms Clark), and Departments of Medicine (Drs Ewy and Kern), Emergency Medicine (Dr Sanders), and Pediatrics (Dr Berg), University of Arizona College of Medicine, Tucson, Arizona.

The Question being asked by the researchers was: Does MICR improve survival from out-of-hospital cardiac arrest in a large urban setting. Note: The Question asked in a research project may have the possible answers: "yes" and "no" as in this study, or may be a numerical result. The preconceived answer by the researchers to the Question is called the Hypothesis. Although the researchers did not indicate their hypothesis, the publication of the article suggests the hypothesis was yes, MICR improves survival from out-of-hospital cardiac arrest in a large urban setting.

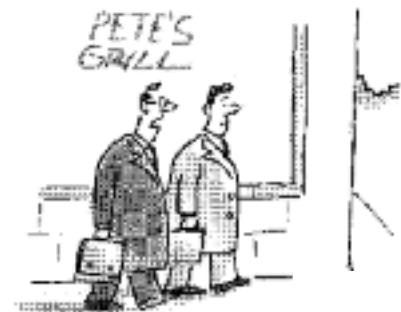
The Methods for the research project describe the study design, setting and steps to answer the Question. The authors proposed an analysis of outcomes of resuscitation before and after training of EMS personnel in two large urban fire departments in Arizona. A train-the-trainer model was used to disseminate the MICR protocol to approximately 2000 EMS firefighters. Outcomes of resuscitation were available from the Arizona program which collects data from EMS. The authors obtained approval to access these data from the Arizona Human Subjects Review Committee. Permission to publish deidentified data was obtained through the University of Arizona Institutional Review Board. The primary outcome measure was survival-to-hospital discharge for all patients with cardiac arrest. The authors performed statistical analyses with Chi-Square or Fisher exact tests by entering the data into SPSS statistical analysis (SPSS Inc, Chicago, Illinois).

The Results section compiles the data to answer the Questions. The authors' reviewed 886 *continued on next page*

Out-of-hospital cardiac arrest is a major public health problem

The Background or Introduction of the research project explains interest in the topic and why the topic is significant. The authors state that out-of-hospital cardiac arrest is a major public health problem and a leading cause of death. They noted that although early defibrillation with automated

external defibrillators has improved survival, early defibrillation rarely occurs. In late 2003, minimally interrupted cardiac resuscitation (MICR) was developed at the University of Arizona as a new approach to out-of-hospital cardiac arrest performed by emergency medical services (EMS) personnel. MICR focuses on maximizing myocardial and cerebral perfusion by: 1) minimizing interruption of chest compressions, 2) providing immediate preshock chest compressions for prolonged ventricular fibrillation, 3) delaying or eliminating endotracheal intubation, 4) minimizing ventilation by positive pressure, and, 5) decreasing the time interval to intravenous epinephrine. The authors noted that MICR discourages performing positive pressure ventilations by substituting passive oxygen insufflation via an oral-pharyngeal airway, a non-breather face mask, and high-flow oxygen. However, since MICR passive ventilation proved a dramatic change for EMS personnel, bag-valve-mask ventilation was still permitted during this study.



"My bank will finance the car. They just won't finance the gas."

cardiac arrests, 218 before MICR training and 668 after MICR training. Survival-to-hospital discharge was 4 of 218 patients (1.8%) in the before MICR training group and in 36 of 668 patients (5.4%) in the after MICR training group. This difference in survival was statistically significant.

The Discussion/Reflections/Future Research starts with a summary discussion of the research. In the Discussion, the authors propose the reason for success of MICR: the forward blood flow produced by chest compressions is so marginal that any interruption of chest compressions is extremely deleterious, especially for favorable neurological outcomes. Since excessive interruptions of chest compressions by EMS personnel are common, MICR emphasizes uninterrupted chest compressions. The Reflections are a comparison with similar research projects and a critique by the authors of their own research project. The authors acknowledge the limitations of their observational study include the fact that the MICR intervention was not tested in a randomized controlled trial. The before and after observational design was intended to minimize selection bias by assessing the same population in the same 2 cities treated by the same fire departments and with the same hospitals before and after implementing MICR instruction. The authors could not exclude the possibility that the MICR training motivated EMS personnel to provide better care independent of the specific MICR protocol. This effect, where participants improve their behavior because they know they are being observed by participating in a study, is called the Hawthorne effect. However, none of the periodic changes in EMS protocols associated with new cardiopulmonary resuscitation and advanced cardiac life support guidelines during the past few decades has resulted in such a dramatic improvement in survival of patients with witnessed out-of-hospital cardiac arrest. The authors also note another limitation of their study was that they compared MICR with the approach used by fire departments in Arizona during a time period when the AHA Guidelines were updated. Therefore, some of the non-MICR fire departments were following the 2000 AHA Guidelines while others were following the 2005 AHA Guidelines. Future Research describes modifications to the project or new projects that would contribute to this research topic. The authors encourage others to conduct randomized controlled trials of MICR to confirm their results in Arizona.

The Conclusion is the final summary of the research project. This project demonstrated that MICR improves survival from out-of-hospital cardiac arrest in a large urban setting. The answer to the Question was yes, and the proposed hypothesis was correct. Acknowledgements credit those who assisted the research project, both by time/effort and by financial support. The authors dedicated their manuscript to the firefighters and paramedics who risk their lives every day to save the lives of others. Conflicts of Interest are listed for all participating in authorship of the research project. Conflicts include advisory board membership, ownership of stock, and receipt of services, honoraria or gifts from companies related to the research project. The authors disclosed no potential conflicts of interest.

The Bibliography section includes references to support the research as included in the manuscript by reference number. For this research project, there were 35 references.

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