Resuscitation 82 (2011) 801–809

Contents lists available at ScienceDirect

Resuscitation

journal homepage: www.elsevier.com/locate/resuscitation

Review article

Management of cardiac arrest in pregnancy: A systematic review☆

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ARTICLE INFO

Article history:
Received 28 June 2010
Received in revised form 17 January 2011
Accepted 26 January 2011

Keywords:
Cardiac arrest
Maternal resuscitation
Systematic review

ABSTRACT

Objective: To describe the consensus on science pertaining to resuscitation of the pregnant patient.
Design: Systematic review.
Data sources: EMBASE, Ovid MEDLINE, Evidence Based Reviews, American Heart Association library and bibliographies of selected articles.
Review methods: The following inclusion criteria were used: pregnancy and cardiac arrest out of hospital, pregnancy and cardiac arrest in hospital, cardiovascular, respiratory, fetal survival, and pharmacology as they relate to cardiac arrest and resuscitation. Non-English papers, case reports and reviews were excluded. Studies were selected through an independent review of titles, abstracts and full article. Two reviewers independently graded the methodological quality of selected articles.
Results: 1305 articles were identified and 5 were selected for further review. There were no randomized trials and overall the quality of the selected studies was good. Two studies examined chest compressions on a manikin in left lateral tilt from the horizontal and concluded that although feasible with increasing degrees of tilt forcefulness of the chest compressions decreases. The third study observed the transthoracic impedance was not altered during pregnancy. One case series and one retrospective cohort study reviewed perimortem cesarean section. Both reports concluded that perimortem cesarean section is rarely done within the recommended time frame of 5 min after the onset of maternal cardiac arrest.
Conclusions: Usual defibrillation dosages are likely appropriate in pregnancy. Perimortem cesarean section is an intervention which is rarely done within 5 min to optimize maternal salvage from cardiac arrest. Chest compressions in left lateral tilt are less forceful compared to the supine position.

Contents

Abbreviations: PMCS, perimortem cesarean section; MOET, Managing Obstetric Emergencies and Trauma; AHA, American Heart Association; ACLS, advance cardiovascular life support; ROSC, return of spontaneous circulation; ILCOR, The International Liaison Committee on Resuscitation.

☆ A Spanish translated version of the abstract of this article appears as Appendix in the online version at doi:10.1016/j.resuscitation.2011.01.028.

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doi:10.1016/j.resuscitation.2011.01.028

1. Introduction

Cardiac disease in the United Kingdom is the most common cause of maternal deaths overall based on the 2003–2005 Confidential Enquiries into Maternal and Child Health[1] data set which constitutes the largest population based data set on this target population. The number of cardiac deaths during pregnancy has been increasing since 1991.[1] Likely contributors to this increase include a rise in the number of women with risk factors for ischemic heart disease[1] and an increase in the number of babies born with congenital heart disease that survive to adulthood.[2]

The incidence of cardiac arrest in pregnancy is reported to be 1:20,000,[1] which is an increase from the 1:30,000 reported in the previous enquiry.[3] Although these numbers are small, they are higher than the incidence of sudden cardiac death in young athletes, estimated to be 1:200,000.[4] Death of an athlete and death during pregnancy are similar in that they both involve young people, however, death during pregnancy involves two lives and attention to this topic has been lacking.

Our objective was to systematically review the literature that may contribute to defining the modifications to advance care life support resuscitation for the pregnant woman based on a consensus of science. To our knowledge the evidence behind the appropriate management of cardiac arrest associated in pregnancy has not been previously systematically reviewed.[7]

2. Methods

2.1. Sources

The literature search was performed using EMBASE (1980–2010 week 10), Ovid MEDLINE (1950–March week 1 2010), all evidence based medicine (EMB) reviews (which include: ACP Journal Club <1991–March 2010>, Cochrane Central Register of Controlled Trials <1st Quarter 2010>, Cochrane Database of Systematic Reviews <1st Quarter 2010>, Cochrane Methodology Register <1st Quarter 2010>, Database of Abstracts of Reviews of Effects <1st Quarter 2010>, Health Technology Assessment <1st Quarter 2010>, NHS Economic Evaluation Database <1st Quarter 2010>) and the American Heart Association Emergency Cardiac Care Endnote Master library. In addition, we hand searched the bibliographies of all selected articles. The details of the search strategies are presented in Table 1 .

2.2. Study selection and evaluation

After the initial search, no randomized trials evaluating the effect of specialized interventions for cardiac arrest associated with pregnancy versus standard care were identified. Therefore, we chose to expand the search to include studies addressing important aspects of maternal physiology which would have a potential impact on the resuscitation of cardiac arrest in pregnancy in an attempt to capture any studies related to resuscitation during pregnancy. The inclusion criteria were pregnancy and cardiac arrest out of hospital, pregnancy and cardiac arrest in hospital, cardiovascular, respiratory, fetal survival, and pharmacology as they relate to cardiac arrest and resuscitation. Review articles, case reports and articles not available in English were excluded. Articles which were purely obstetrical in nature with no link to resuscitation were excluded. Two authors (FJ, CZ) completed the literature search and selected by consensus the studies based on inclusion criteria as judged by title, abstract and complete manuscript. Two authors (FJ, RW) independently evaluated the methodological quality of the selected articles using the quality list described by Hayden[8] as adapted by Moulaert et al.[9] This particular scoring method was chosen to allow a standardized comparison of quality across the heterogeneity of study designs employed in the selected studies. Based on this quality assessment tool, each article was evaluated for their risk of bias in 5 domains: study participation, study attrition, outcome measurement, confounding measurement and statistical analysis. For each article, each domain was rated for the risk of bias with low receiving 2 points, medium receiving 1 point and high receiving 0 points. This would give a potential score for each study between 0 (indicating poor quality) to 10 (indicating excellent quality) (Appendix A).

The weighted kappa score was used to assess the degree of concordance between the two reviewers of methodological quality.[10] The weighted kappa score measures the strength of agreement between the two reviewers. Scores up to 0.2 reflect poor agreement while values over 0.8 demonstrate substantial agreement.

3. Results

The search strategy initially identified 1305 citations. Assessment of the articles for the stated inclusion and exclusion criteria based on title, abstract or full text resulted in 5 articles being selected for final review (see Fig. 1). The search strategy included pregnancy related topics and although the search strategy attempted to narrow the field to resuscitation related articles only, many citations retrieved had no relevance to resuscitation science or practice. For example, many articles dealt with purely obstetrical and obstetrical anesthesia related topics.

There was substantial agreement between the reviewer's quality scores, with a weighted kappa score of 0.82. The quality assessment score and a summary for each of the selected articles are presented in Table 2.

3.1. Consensus on science by category

3.1.1. Perimortem cesarean section

There was one case series on perimortem cesarean section and one study evaluating the rate of perimortem cesarean section before and after an education intervention aimed at improving the use of this procedure.[11,12] In the case series of 38 cases in this category,[11] the perimortem cesarean section was performed within the recommended 4–5 min time frame after the onset of maternal cardiac arrest in only 8 of 38 cases. Seventeen infants were born without sequelae, and 4 of these infants who were 30–38 weeks gestational age were born >15 min after the onset of maternal cardiac arrest. Of the 22 cases which provided enough information regarding the effects of the cesarean delivery on maternal hemodynamic status, twelve women had sudden and often dra-