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Clinical Paper

Cardiopulmonary resuscitation of pregnant women in the emergency department☆

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ABSTRACT

Aim: Little is known about outcomes of cardiopulmonary resuscitation (CPR) in pregnancy. The purpose of this study was to determine the prognostic value of pregnancy in women receiving CPR in the emergency department (ED).
Methods: We conducted a population-based, matched cohort study using the Nationwide Emergency Department Sample (NEDS) from 2006 to 2010. A cohort of pregnant women receiving CPR in the ED was compared to an age-matched cohort of non-pregnant women at a 1:10 ratio. Conditional logistic regression was used to calculate the odds ratio (OR) and corresponding 95% confidence intervals (95% CIs) for variables of interest and survival.
Results: Among 8162 women requiring CPR in the ED, we identified 157 pregnant women. Pregnancy was associated with better overall survival of 36.9% compared to 25.9% in non-pregnant women, OR 1.89 (1.32–2.70), $p < 0.01$. Traumatic injury was identified as a significant predictor of outcome in pregnancy. In non-trauma patients, pregnant women had significantly better odds of surviving CPR than non-pregnant women, OR 2.10 (1.41–3.13), $p < 0.01$. In cases of trauma, no significant difference was observed between groups.
Conclusion: Although further studies are needed, CPR in pregnancy is associated with a better prognosis compared to non-pregnant women, with trauma status being a key factor predicting outcome in the pregnant patient.

1. Introduction

Cardiopulmonary resuscitation (CPR) is a life saving measure, which has been used for over 50 years.[1] In pregnancy, need for CPR is a rare event, occurring in approximately 1 in 20,000 pregnancies.[2] Within the last few decades, increasing maternal age and comorbid disease have been putting women at higher risk of obstetric complications, therefore increasing their likelihood of cardiopulmonary arrest and need for resuscitation.[3,4] In fact, the frequency of CPR in pregnancy was previously reported to be 1 in 30,000.[5] Because of its rarity and the physiologic changes associated with pregnancy, most physicians have little or no experience with CPR in pregnancy.[6] Although outcomes have already been well described in the adult population, there is paucity of knowledge concerning survival and predictors of outcome in pregnant women.[7] Recognizing that most information in the literature is in the form of case reports, we sought to evaluate the survival rate and identify predictors of outcome in pregnant women requiring CPR in the emergency department (ED).

2. Methods

Data obtained from the Health Care Cost and Utilization Project, Nationwide Emergency Department Sample (HCUP-NEDS) were used to carry out a population-based matched cohort study, with a ratio of 1 case to 10 controls. The HCUP-NEDS contains data on United States hospital ED visits from 2006 to 2011, inclusively, and approximates 20% of United States hospital ED visits. These include visits to rural and urban, as well as teaching and nonteaching hospitals. The database includes clinical and resource information during ED visits, including demographic information, admissions, injuries, diagnoses (up to 15), procedures categorized according to the International Classification of Disease, 9th Revision, Clinical

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Table 1
Baseline characteristics of women having received cardiopulmonary resuscitation.

Characteristics	Pregnant *N* = 157 (%)	Non-pregnant *N* = 1570 (%)
Age (years)		
<25	56 (35.4)	560 (35.4)
25–34	69 (43.7)	698 (44.2)
>35	33 (20.9)	322 (20.4)
Median household income		
<25th percentile	57 (36.8)	493 (32.3)
25th–50th percentile	33 (21.3)	456 (29.9)
51st–75th percentile	36 (23.2)	343 (22.5)
76th–100th percentile	29 (18.7)	234 (15.3)
Hospital		
Rural	19 (12.1)	315 (20.1)
Urban non-teaching	68 (43.3)	693 (44.1)
Urban teaching	70 (44.6)	562 (35.8)
Region		
Northeast	24 (15.3)	271 (17.3)
Midwest	28 (17.8)	307 (19.6)
South	77 (49.0)	749 (47.7)
West	28 (17.8)	243 (15.5)

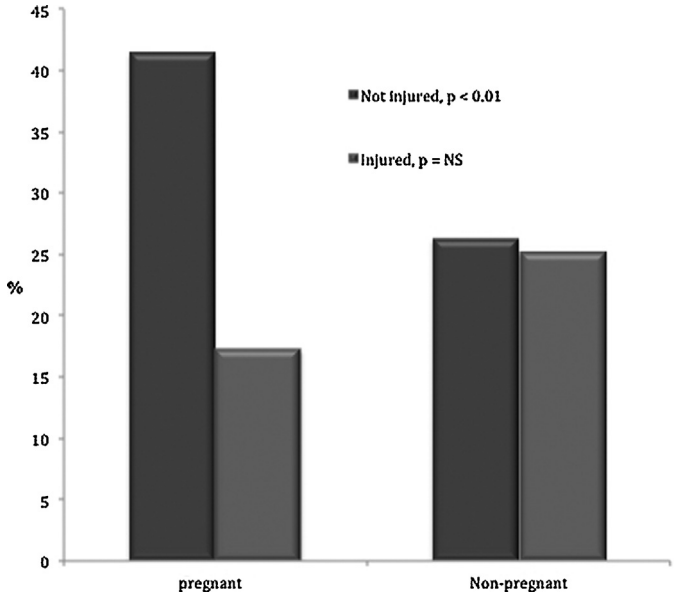

Fig. 1. Effect of traumatic injury on survival.

Modification (ICD-9-CM) and the Current Procedural Terminology (CPT), as well as death in ED, if present.

A cohort of women having received CPR between 2006 and 2010 was isolated using the following ICD-9-CM codes 99.60, 99.63, 37.91 and CPT codes 32160, 92950. Pregnant women having received CPR were identified by obtaining patients with pregnancy or delivery codes and a CPR code. CPR-associated death during ED visit was identified when 'Died in ED' was indicated under disposition from ED of patients in the HCUP-NEDS database, combined with any of the CPR codes. Non-pregnant controls were identified and age-matched at a 10 to 1 ratio.

Baseline characteristics included age, income, hospital type, hospital region and type of insurance. All predictors of survival were identified using the database. These included hospital type, income, traumatic injury and whether the hospital was a trauma center.

Crude and adjusted odds ratios (ORs) and corresponding 95% confidence intervals (CIs) were calculated using conditional logistic regression. Our model was adjusted for baseline characteristics. We used a two-tailed analysis and considered p-values <0.05 as statistically significant. This study was approved by the Medical Research Ethics Department of the Jewish General Hospital. All analyses were performed with the statistical software package SAS 9.4 (SAS Institute, Cary, NC, USA).

3. Results

During the 5-year period of investigation, there were a total of 8162 women having received CPR. One hundred and fifty seven pregnant and 1570 age-matched non-pregnant women were identified as having received CPR in the ED. Comparison of baseline characteristics (Table 1) demonstrated that pregnant women requiring CPR in the ED had higher incomes compared to non-pregnant women. Pregnant women receiving CPR were also less likely to visit rural hospitals.

Rates of overall survival for CPR in the ED were 36.9% in pregnant women and 25.9% in non-pregnant women with an adjusted OR of 1.89 (95% CI 1.32–2.70). Among pregnant women, traumatic injury status and hospital type played an important role in terms of outcome. Non-trauma pregnant women requiring CPR had significantly higher odds of survival compared to non-trauma non-pregnant women OR of 2.10 (95% CI 1.41–3.13). In patients having suffered traumatic injuries, no difference was observed between pregnant and non-pregnant women. Age between 25 and 34 years was associated with higher odds of survival in pregnant women. CPR in urban non-teaching hospitals was also associated with improved survival in pregnancy compared to non-pregnant women, whereas no difference was observed between groups for both rural and urban teaching hospitals (Table 2 and Fig. 1). Among pregnant patients having received CPR in the ED, 22 underwent cesarean section, of which only one survived. However, time of cesarean, perimortem or postmortem, could not be determined within the database.

4. Discussion

To the best of our knowledge, this is the first study evaluating survival and predictors of outcome in ED CPR of pregnant women. Our study found that pregnant women have statistically significant higher overall odds of surviving CPR. We also found that trauma status and hospital type are key players in terms of outcomes in pregnant women. Non-trauma pregnant women have significantly better odds of survival compared to non-pregnant women. Urban non-teaching hospitals also had significantly higher rates of survival in pregnancy compared to non-pregnant women. There was no significant difference in survival in both rural and urban teaching hospital centers, however fewer pregnant women were admitted to the EDs of rural hospitals. In patients who suffered traumatic injuries, there was no difference in survival between pregnant and non-pregnant women.

Although pregnant women receiving CPR in the ED had better overall rates of survival compared to non-pregnant women, trauma status was a primary factor in terms of positive outcome in pregnancy. Survival in trauma patients requiring CPR in the ED is known to be poor with reported survival rates of 0–22.9% for adults.[8,9] While there was no difference in outcome between pregnant and non-pregnant women suffering from traumatic injury, non-trauma pregnant patients had significantly better odds of survival than non-trauma non-pregnant women. A possible explanation revolves around the physiologic changes which occur in pregnancy. These include increased cardiac output by 30–50% by 32 weeks gestation, as well as increased heart rate, oxygen consumption and minute ventilation.[10] Although 30% of cardiac output is directed to the uterus in pregnancy compared to 2% in non-pregnant patients, the