The Application of Rapid Response Team in Category 1 Emergency Caesarean Section Teaching for OBGYN Residents in the Delivery Room

Xia Xu
Fujian Maternity and Child Health Hospital College of Clinical Medicine for Obstetrics & Gynecology and Pediatrics, Fujian Medical University

Ying Lin
Fujian Maternity and Child Health Hospital College of Clinical Medicine for Obstetrics & Gynecology and Pediatrics, Fujian Medical University

Ling Weng
Fujian Maternity and Child Health Hospital College of Clinical Medicine for Obstetrics & Gynecology and Pediatrics, Fujian Medical University

Yanni Guo
Fujian Maternity and Child Health Hospital College of Clinical Medicine for Obstetrics & Gynecology and Pediatrics, Fujian Medical University

Lin Lin
Fujian Maternity and Child Health Hospital College of Clinical Medicine for Obstetrics & Gynecology and Pediatrics, Fujian Medical University

Jianying Yan (yanjy2019@fjmu.edu.cn)
Fujian Maternity and Child Health Hospital College of Clinical Medicine for Obstetrics & Gynecology and Pediatrics, Fujian Medical University

Research Article

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Abstract

Background

Category 1 caesarean section (CS) can be a life-saving procedure when there is immediate threat to the life of the woman or fetus. However, category 1 CS is a challenge for OBGYN residents, and it is necessary to establish an effective and straightforward teaching strategy. This study aimed to evaluate the efficiency of rapid response team (RRT) on category 1 CS teaching for OBGYN residents in the delivery room.

Methods

A total of 142 residents who underwent standardized residency training programs in the delivery room were divided into a RRT teaching group and a traditional response (TR) teaching group. In the RRT teaching group, Category 1 emergency CS teaching was started and explored by rapid response team. The training included both theoretical and practical components. After the training, decision-to-delivery interval (DDI), neonatal Apgar score, operation time and rate of postpartum hemorrhage (PPH) were compared. A questionnaire on the subjective assessment of various aspects of the program was conducted at the end of the training period.

Results

The decision-to-delivery interval (DDI) in minutes in the RRT teaching group (n=72) was significantly shorter than that of the TR teaching group (n=70) (11.83±4.16 vs 13.56±5.47, p = 0.0364). The score of satisfaction from residents in the RRT teaching group was significantly higher than that of the TR group [7 (6, 9) vs 9 (7, 10), p =0.0154 ). Compared with the TR teaching group, more residents thought their clinical skills have been improved (94.29% vs 100%, p=0.0396) and willing to recommend their training method to others (91.43% vs 100%, p=0.0399) in the RRT teaching group. However, no significant differences were observed in the incidence of postpartum hemorrhage between the two groups.

Conclusions

RRT teaching is beneficial in the standardized training and teaching of residents in the delivery room. It improves the DDI of category 1 emergency caesarean section and the degree of satisfaction.

Introduction

Maternal and fetal morbidity and mortality are significant public health concerns in worldwide[1–5]. Obstetric emergencies in the delivery room such as uterine rupture, placenta abruption and cord prolapse are significant contributors[6–9]. Emergency caesarean section (CS) sometimes is a life-saving procedure for these life-threatening conditions[10, 11]. Depending on the severity of the fetal and/or maternal condition, emergency CS is categorized into four-category[12] that are category 1, category 2, category 3 and category 4. Category 1 CS is when there is immediate threat to the life of the woman or fetus, for
example, suspected uterine rupture, major placental abruption, cord prolapse, fetal hypoxia or persistent fetal bradycardia. Team performance, rapid response, effective communication, critical thinking and leadership are recommended during Category 1 CS to improve perinatal outcomes. Rapid response team (RRT) is a multidisciplinary team staffed by healthcare professionals with expertise in critical care. RRT was established and applied in Category 1 CS in Fujian Maternity and Child Health Hospital since 2015. Not surprisingly, the application of RRT improved perinatal outcomes as reported in other studies.

Resident training is a crucial stage of progressing for an obstetric and gynecology (OBGYN) doctor. During this procedure, resident doctors need to preview and accept a large amount of theoretical knowledge, practice and command basic clinical skills and learn to handle kinds of severe emergency situation. Residents are important members of the delivery team and should be prepared and trained against all risks including Category 1 CS in the delivery room.

However, whether RRT can be quickly mastered by residents and improve the perinatal outcomes remains to be elucidated. Therefore, this study aimed to study the perinatal outcomes of patients and explore the self-evaluation and satisfaction of residents after receiving RRT training.

**Methods**

**Study population**

All residents who underwent resident standardizing training from January 2020 to January 2021 in the delivery room of Fujian Maternity and Child Health Hospital accepted TR teaching (n = 70) and all residents who underwent resident standardizing training from January 2021 to January 2022 in the delivery room of Fujian Maternity and Child Health Hospital accepted RRT teaching (n = 72). The theory and program of emergency CS especially Category 1 were introduced to all residents in the first week of training. Residents in traditional response (TR) teaching group practiced response to category 1 CS in traditional response mode that category 1 CS was launched and responded by resident-self and managed by teacher. Residents in RRT teaching group practiced response to category 1 CS in RRT mode. The composition and schematic diagram of RRT was showed in Fig. 1 and Fig. 2.

Category 1 emergency CS was launched once immediate threat to the life of the woman or fetus (for example, suspected uterine rupture, major placental abruption, cord prolapse, fetal hypoxia or persistent fetal bradycardia). RRT was applied in category 1 CS in Fujian Maternity and Child Health Hospital since 2015. The policy and process of RRT had been established and refined.

**Outcome Measures**

Baseline characteristics of all residents enrolled in the study was analyzed and compared and achieved satisfactory teaching results, which can provide a basis for promoting the clinical training teaching method of category 1 CS in the future, which is reported as follows. The outcomes of all patients who
underwent category 1 CS from January 2020 to January 2021 in the delivery room of Fujian Maternity and Child Health Hospital was compared with that of all patients who underwent category 1 CS from January 2021 to January 2022.

**Statistical analysis**

The normality of data was assessed by the Kolmogorov–Smirnov test. The categorical variables are expressed in percentages, the continuous variables with normal distribution are expressed as mean ± SD, and the non-normally distributed continuous variables are expressed as median (quartile spacing) values. For two groups with continuous variables, the two-sample independent t-test was used when each set of data was normally distributed with homogeneous variance; otherwise, the Mann–Whitney U test was used. Categorical variables were analyzed with the Chi-square test or Fisher exact probability method. Statistical analysis were performed with SPSS 26.0. Differences were considered statistically significant if \( P < 0.05 \).

**Results**

There were 70 residents in the TR group and 72 residents in the RRT group. There were no significant differences in age, gender, education and entrance examination scores between the two groups (Table 1).

<table>
<thead>
<tr>
<th>Parameters</th>
<th>TR-G (n = 70)</th>
<th>RRT-G (n = 72)</th>
<th>( P )-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (mean ± SD, years)</td>
<td>26.72 ± 4.04</td>
<td>25.43 ± 3.72</td>
<td>0.051</td>
</tr>
<tr>
<td>Gender (No. [%])</td>
<td></td>
<td></td>
<td>0.585</td>
</tr>
<tr>
<td>male</td>
<td>13</td>
<td>16</td>
<td></td>
</tr>
<tr>
<td>female</td>
<td>57</td>
<td>56</td>
<td></td>
</tr>
<tr>
<td>Education (No. [%])</td>
<td></td>
<td></td>
<td>0.310</td>
</tr>
<tr>
<td>undergraduate</td>
<td>17</td>
<td>23</td>
<td></td>
</tr>
<tr>
<td>Postgraduate or doctor</td>
<td>53</td>
<td>49</td>
<td></td>
</tr>
<tr>
<td>Entrance examination scores</td>
<td>83.43 ± 6.72</td>
<td>82.72 ± 7.64</td>
<td>0.555</td>
</tr>
</tbody>
</table>

Abbreviations: G, group; RRT, rapid response team; TR, traditional response

After the training, there were no apparent differences in the baseline characteristics of the patients (age, dilatation of cervix, and history of cesarean section) that we included between the two groups (Table 2).

The decision-to-delivery internal (DDI) in minutes in the RRT teaching group was significantly shorter than that of the TR teaching group (11.83 ± 4.16 vs 13.56 ± 5.47, \( p = 0.0364 \)). However, no significant
differences were observed in the neonatal Apgar score, weight of neonate and incidence of postpartum hemorrhage between the two groups.

Table 2
Comparison of clinical characteristics and outcomes between the two groups

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>TR-G (n = 70)</th>
<th>RRT-G (n = 72)</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maternal age (mean ± SD, years)</td>
<td>28.52 ± 5.68</td>
<td>29.27 ± 6.41</td>
<td>0.464</td>
</tr>
<tr>
<td>Dilatation of cervix (mean ± SD, cm)</td>
<td>5.35 ± 1.12</td>
<td>6.53 ± 1.42</td>
<td>1.711</td>
</tr>
<tr>
<td>History of cesarean section</td>
<td></td>
<td></td>
<td>0.672</td>
</tr>
<tr>
<td>none</td>
<td>68</td>
<td>69</td>
<td></td>
</tr>
<tr>
<td>one</td>
<td>2</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>DDI (mean ± SD, years)</td>
<td>13.56 ± 5.47</td>
<td>11.83 ± 4.16</td>
<td>0.0364</td>
</tr>
<tr>
<td>Neonatal Apgar score (median [IQR], score)</td>
<td>8 (7, 9)</td>
<td>9 (7, 10)</td>
<td>0.354</td>
</tr>
<tr>
<td>Neonatal gender (No. [%])</td>
<td></td>
<td></td>
<td>0.729</td>
</tr>
<tr>
<td>boy</td>
<td>32</td>
<td>35</td>
<td></td>
</tr>
<tr>
<td>girl</td>
<td>38</td>
<td>37</td>
<td></td>
</tr>
<tr>
<td>Weight of neonate (median [IQR], g)</td>
<td>3450.77 ± 17.98</td>
<td>3368.34 ± 16.29</td>
<td>2.111</td>
</tr>
<tr>
<td>Postpartum hemorrhage (No. [%])</td>
<td>3 (4.29)</td>
<td>4 (5.56)</td>
<td>0.727</td>
</tr>
</tbody>
</table>

A total of 142 questionnaires were distributed in two groups and 142 were recovered, representing a 100% return rate. Before data entry, all questionnaires were checked for logic and integrity. As shown in Table 3, the score of satisfaction from residents in the RRT teaching group was significantly higher than that of the TR group [7 (6, 9) vs 9 (7, 10), p = 0.0154]. Compared with the TR teaching group, more residents thought their clinical skills have been improved (94.29% vs 100%, p = 0.0396) and willing to recommend their training method to others (91.43% vs 100%, p = 0.0399) in the RRT teaching group. However, no significant differences were observed in the incidence of postpartum hemorrhage between the two groups.
Table 3
Comparison of the results of questionnaire between the two groups

<table>
<thead>
<tr>
<th>Entries</th>
<th>TR-G (n = 70)</th>
<th>RRT-G (n = 72)</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Have you improved your learning interests?</td>
<td>Yes</td>
<td>No</td>
<td>Uncertain</td>
</tr>
<tr>
<td></td>
<td>64</td>
<td>6</td>
<td>0</td>
</tr>
<tr>
<td>Have you improved your clinical skills?</td>
<td>Yes</td>
<td>No</td>
<td>Uncertain</td>
</tr>
<tr>
<td></td>
<td>66</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>Have you improved your theoretical knowledge of</td>
<td>Yes</td>
<td>No</td>
<td>Uncertain</td>
</tr>
<tr>
<td>emergency caesarean section?</td>
<td>69</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Will you recommend this method to others?</td>
<td>Yes</td>
<td>No</td>
<td>Uncertain</td>
</tr>
<tr>
<td></td>
<td>64</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>Is it helpful for your clinical work in the future?</td>
<td>Yes</td>
<td>No</td>
<td>Uncertain</td>
</tr>
<tr>
<td></td>
<td>65</td>
<td>0</td>
<td>5</td>
</tr>
<tr>
<td>Teaching satisfaction score (median [IQR])</td>
<td>Yes</td>
<td>No</td>
<td>Uncertain</td>
</tr>
<tr>
<td></td>
<td>7 (6, 9)</td>
<td>9 (7, 10)</td>
<td></td>
</tr>
</tbody>
</table>

Abbreviations: G, group; RRT, rapid response team; TR, traditional response

Discussions

Urgent situation including suspected uterine rupture, major placental abruption, cord prolapse, fetal hypoxia or persistent fetal bradycardia sometimes occurs in the delivery room. Category 1 CS can be a life-saving procedure for above life-threaten emergencies. RRT was applied in category 1 CS in Fujian Maternity and Child Health Hospital since 2015. Residents are important members of the delivery team and should be prepared against Category 1 CS in the delivery room. However, resident routine training in delivery room was in traditional response mode. Whether RRT teaching mode can be quickly mastered by residents and improve the perinatal outcomes remains unclear. Therefore, this study aimed to study the perinatal outcomes of patients and explore the self-evaluation and satisfaction of residents after application of RRT teaching in residents about Category 1 CS. The primary finding was that decision-to-delivery internal (DDI) in minutes in the RRT teaching group was shorter than that of the TR teaching group and no increase in complications. We also found that more residents thought their clinical skills had been improved, satisfy and willing to recommend RRT training method to others. However, no significant differences were observed in the incidence of postpartum hemorrhage between the two groups.

Caesarean section (CS) is the commonest major obstetric surgery and a life-saving intervention sometimes. It is divided into planned CS and emergency CS [13]. Take into account the condition of the woman and the unborn baby, emergency CS is categorized into four category. Category 1 - Immediate threat to the life of the woman or fetus. Category 2 - Maternal or fetal compromise which is not immediately life-threatening. Category 3 - No maternal or fetal compromise but needs early birth. Category 4 - Birth timed to suit woman or healthcare provider. To improve maternal and neonatal outcomes, it is recommended that the time from decision of category 1 emergency CS to the birth of the
baby (decision-to-delivery interval, DDI) should be within 30 minutes[9, 14, 15]. In order to achieve the 30 minutes goal, the whole process of category 1 CS that should be performed perfectly as far as possible. Accordingly, a rapid response multidisciplinary team, including, obstetricians, anaesthesiologist, paediatricians and other related personnel was established in order to shorten the DDI for category 1 emergency CS. As some studies reported, 30 minutes goal can be achieved in this study after application of rapid response team (RRT).

However, it should be noted that category 1 emergency CS is launched against with immediate threat to life of the woman or fetus. Some studies demonstrated that short DDI could improves perinatal outcomes. Our hypothesis was that resident trainees act as front line caregivers in delivery room and an important member during category 1 emergency CS, accept RRT teaching may short DDI. The DDI in the RRT teaching group indeed shorter. The results reflect that strengthen collaboration of residents with all related staff can short DDI. However, the incidence of postpartum hemorrhage did not increase. This was similar to other previous studies which demonstrated that various quality improvement programs including continuous education and team training course for obstetric and related staff with emphasis on the importance of achieving the standard of 30-minutes goal, can significantly shorten DDI and other processes[16–18].

This study has some limitations. First, to ensure the homogeneity of educational interventions, these data were obtained at a single teaching hospital, and validation from other institutions is needed. Second, RRT need practice again and again. So RRT teaching is time-consuming. Most resident trained in the delivery room for 2 months. Undoubtedly, this may reduce the effect of RRT training. Third, this is a case control study and if a randomized controlled trial can be performed will be better.

**Conclusions**

The application of RRT teaching in the standardized teaching of residents improves the DDI of category 1 emergency caesarean section and the degree of satisfaction. We therefore recommend this teaching method.

**Abbreviations**

RRT Rapid response team

DDI Decision-to-delivery interval

CS Caesarean section

TR Traditional response

OBGYN Obstetrics and gynecology

PPH postpartum hemorrhage
Declarations

Acknowledgements

Not applicable.

Author's contributions

XX and YL carried out the studies, participated in collecting data, and drafted the manuscript. LW participated in questionnaire design and statistical analysis. XX and LL participated in skills teaching and student management. YN G participated in collecting data. JY Y participated in the design of the study, read and approved all stages of the manuscript. All authors read and approved the final manuscript.

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Availability of data and materials

The datasets generated and analyzed during the current study are not publicly available due to limitations of ethical approval involving the patient data and the confidentiality of resident information but are available from the corresponding author on reasonable request.

Declarations

All the residents who underwent resident standardized training signed the training agreement before entering the hospital. It is the obligation of resident to receive skill training, so there was no written informed consent for the resident receiving training in the study. All residents included in this study accepted standardized training that provided by the hospital. All patients included in this study met the Class 1 cesarean section indication and signed the preoperative informed consent form. It is a case control study, so there was no written informed consent for patient in this study. All the procedures were followed in accordance with Declaration of Helsinki. The ethics committee of Fujian Maternity and Child Health Hospital approved this consent process and also specifically approved this study (Grant number: 2022KYLLRK1103).

Consent for publication

Not applicable.

Competing interests

The authors declare that they have no competing interests.
References


**Figures**

![Diagram showing the composition of a rapid response team for emergency caesarean section]

**Figure 1**

Composition of rapid response team for emergency caesarean section
Figure 2

Schematic diagram of rapid response team for emergency caesarean section