

Article (Original Investigation)

# The Impact of Collaborative Care on Intraoperative Stress in Patients Undergoing Cesarean

## A Randomized Controlled Trial

Dong Ying Fu, BNR; Jia Nan Jiang, BNR; Bi Chao Wang, BNR; Wen Jia Guo, MSc

**OBJECTIVE** The aim of this study is to evaluate the effect of collaborative intervention on stress relief in patients undergoing elective Cesarean section.

**METHODS** A total of 142 participants undergoing CS were randomly divided into three groups: Single intervention (group A: Control), Collaborative care (group B: Experiment), and Routine care (group C: Control). Group A: circulation nurse provided preoperative visiting followed the psycho-leaflets the day prior surgery. On the surgery day, patients were offered the routine care. Group B: collaborative care was offered by multidisciplinary teams started from the day before surgery to the postoperative period, including preoperative visiting and specialized therapies. Group C: routine care was implemented following the medical order. Salivary cortisol was sampled as the primary outcome to measure stress response at different time points. Self-rated satisfaction scores were obtained three days after surgery.

**RESULTS** Cortisol level in the group B was the lowest during the surgery ( $P < 0.05$ ). The mean satisfaction score of this group was significantly higher than the other control groups ( $P < 0.05$ ). Cortisol levels of the group A were lower than the group C 30 min after preoperative visiting ( $P < 0.05$ ).

**CONCLUSION** The data suggest that collaborative care can substantially reduce stress in patients undergoing Cesarean section. ■

**KEYWORDS** Collaborative care; Cortisol level; Cesarean section

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**Author Affiliations:** Author affiliations are listed at the end of this article.

**Correspondence to:** Nr. Dong Ying Fu, BNR, Department of OR, Nanjing Maternity and Children Health Hospital, Nanjing Medical University, Nanjing 210004, China; (Tel: +86 25 5222 6112; Fax: +86 25 8420 0723; Email: fujh691007@163.com)

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Fear is common for a surgical patient. It is well-established that stressful experience can exacerbate hormonal responses, for instance, elevated cortisol level evoked by surgical stress (1), and stress in pregnant patients may inhibit pulsatile oxytocin release, which contributes to postpartum hemorrhage (1). Under situations of excessive stress, the blood flow in uterus and fetus would markedly decrease that poses direct threat to the health of the fetus (2). Cumulating evidence indicated that most patients undergoing Cesarean section (CS) concern about their infants' wellbeing, perioperative pain, adverse reaction of anesthetics, and unknown procedures and post-operative recovery (3).

For perioperative nurses, they are responsible for assisting patients to cope with the stress introduced by upcoming procedure. Previous studies proposed that psychoprophylactic visiting is strongly associated with surgical patient's stress reduction. This study will test the hypothesis that collaborative care is a superior approach that is effective in managing CS-related stress through comparing salivary cortisol as the primary outcome in three specialized groups.

## METHODS

### Ethical Considerations

This study was carried out from June to December 2014 at a tertiary teaching hospital in Nanjing, China, after approval by the Institutional Ethics Committee. One hundred forty two Chinese pregnant patients who had C-section had provided informed consent for study participation.

### Study Design

#### Inclusion Criteria

Nulliparity, singleton pregnancy, gestational age > 37 wk, and epidural analgesia.

#### Exclusion Criteria

Hearing impairment, sedative and hypnotic drugs administration, mental illness, alcohol abuse, and endocrine problems.

#### Demographic Variables

The demographic data were collected as follows: age, height, weight, gestational age, economic status, pregnancy education, blood pressure, heart rate, respiratory rate and salivary cortisol level. All the patients were not

smokers. There was no statistic difference among three groups regarding gestational age, height, weight, literacy degree, and the effect of analgesia ( $VAS \leq 3$ ). The general information of three groups is displayed in Table 1.

### Randomization and Allocation

Patients with the diagnoses for C-section delivery were enrolled in this study after they provided the informed consent. These patients were randomly allocated to Single intervention group (the Control A) or Collaborative care group (the Experiment B) or Routine care group (the Control C). The random-number list was generated by means of the QuickCalcs. The trained nurses got the instructions from a sealed envelope before they provided the interventions for these patients.

### RN Training and Cooperation

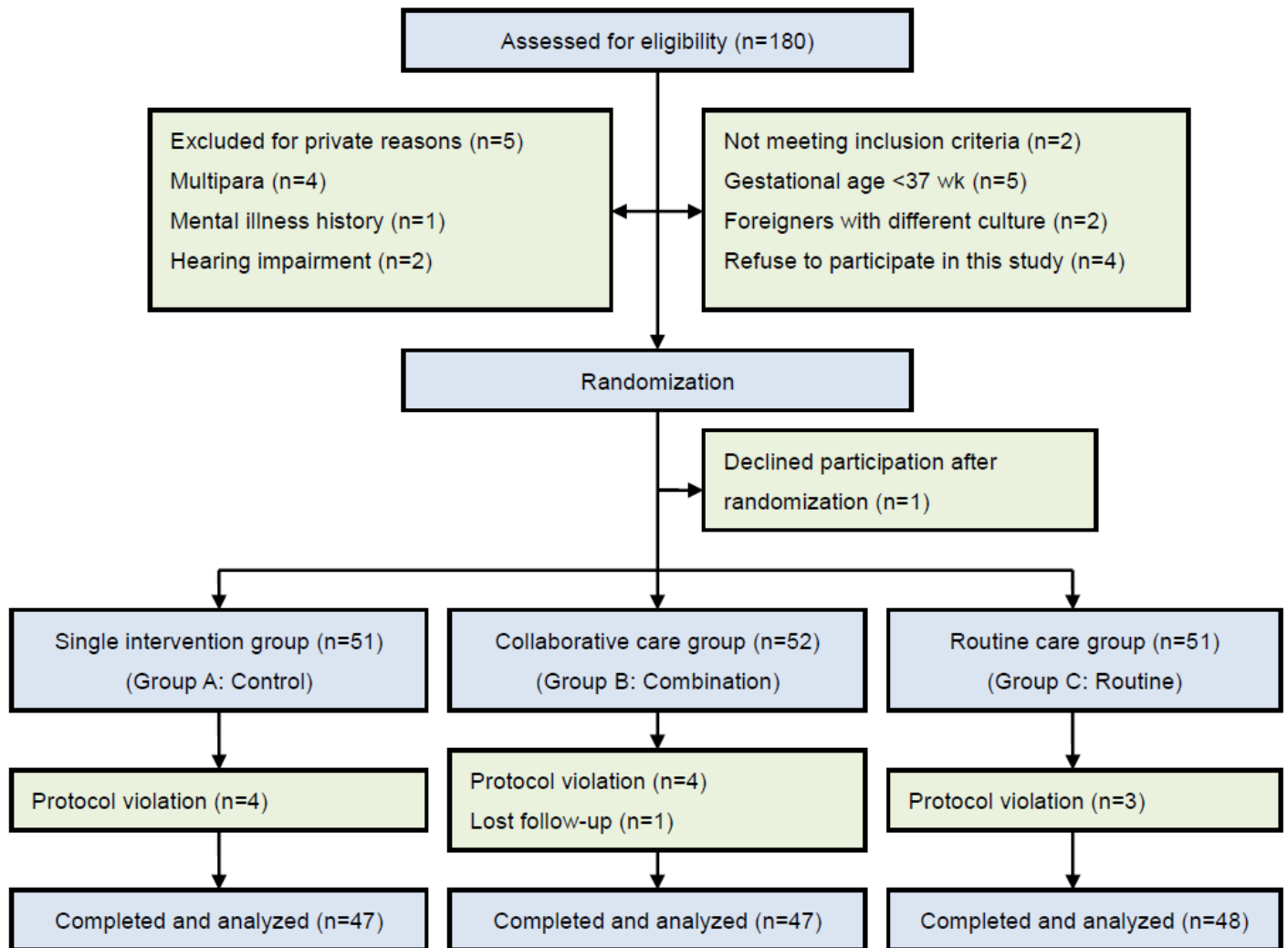
A total of 15 RNs involved in this study were trained in a full-term course one month before the study begin, including communication skills, psychological care for a surgical patient, peripartum care and data collection program. These RNs were divided into three groups and draw lots to select five members for each group. The median age of RNs was 29 years (interquartile range, 25-33 years), and they had a mean of seven years experience in obstetric OR. The workshop for the study training and discussing were run every weekend until the study was completed. Doula and other medical staff may help with the collaborative care including alternative therapies and comfort measures, such as therapeutic touch, music therapy, massage, aromatherapy, breathing techniques, stress-free exercise, and traditional herb therapy, etc, additionally, all therapeutic treatments were only offered for patients in the experiment B group.

### Interventions for Each Group

#### Single Intervention Group (The Control A)

##### The Day before Surgery

Circulation nurse visited patients to provided detailed information regarding procedure (Table 2). Patients should be encouraged to ask questions freely. It is significant to build up a reliable relationship between health care providers and patients, while also establish clients' confidence (4). The intervention for the control A focused on the formal psychological support following the psychological care guidelines. In order to alleviate clients' nervousness, Nurses provided patients and their

**Figure 1. Flowchart of Patients' Enrollment and Randomization**

Four patients refused to participate in this study, five patients excluded for private reasons. One patient lost follow-up, because they moved to another province. Fourteen patients were excluded for medical reasons. Two patients came from different ethical group, they have different cultures, staff cannot communicate well with them, and hence they were not involved in this study. Only 142 patients accepted to complete this study.

families with necessary information of impending surgery including the interventions prepared for emergent situations (5).

#### The Day of the Surgery

Routine care was implemented according to the nurses' experience and medical prescription. Doula and alternative therapists were not involved in this group (Table 3).

#### Collaborative Care Group (The Experiment B)

##### The Day before Surgery

Scout nurse may offer a comprehensive nursing assessment and preoperative education after access the health

information by reviewing patient's medical chart (Table 2). Patients should be provided opportunities to ask any questions regarding their operation. It's necessary to establish a reliable relationship and increase patient's confidence towards the procedure (4). Psychological care for this group is to provide basic emotional support for new mothers and their families. Nurses would explain the impending procedure step by step, in addition, relevant information including emergent plan was also provided through preoperative visiting to support patients and their families (5). Interdisciplinary team may offer alternative anxiety-reduction methods depending

**Table 1. General Information for Three Groups**

Characteristic	Group A (Control) (n=47)	Group B (Experiment) (n=47)	Group C (Routine) (n=48)
Age (yr)	28±5	27±6	27±7
Height (cm)	162±11	164±9	160±8
Wight (kg)	75±11	72±12	74±11
Gestational age (wk)	38 (37-40)	38 (37-40)	38 (37-40)
Blood pressure (mmHg)			
Systolic blood pressure	118±24	117±21	119±24
Diastolic blood pressure	77±17	76±16	78±18
Respiration rate (bpm)	16±3	17±2	16±2
Heart rate (bpm)	74±8	76±7	77±7
Salivary cortisol (baseline)	11.5±1.3	11.3±1.3	11.4±1.5

Mean and standard deviation by t-test. Data are presented as mean ± standard deviation (SD). Gestational age presented as median (IQR). There were no significant difference among the three groups ( $P>0.05$ ).

on individuals' preferences, such as stress-free exercises and aromatherapy.

### The Day of the Surgery (Table 3)

#### Preoperative Period

Doula may offer some comfort selections. Staff should encourage patients to take a positive attitude and provide them with an example of the successful case. Assist patients with positioning for the epidural analgesia. Nurses may hold their hands, or gently touch their forehead to make them feel safe. Patients can enjoy their favorable music or watch TV or do some interesting readings in the holding bay, and all the sounds should remain soft. If patients feel extremely stressful, doula can teach them breathing skills and chat with them to distract their attention from the surgery (5, 6). Urinary catheterization should be done after epidural anesthesia. Alternative therapies may be provided according to patients' choices in the holding bay, such as therapeutic music, breathing techniques. Staff providing the interventions should consider the patients' concerns and needs.

#### Intraoperative Period

Doulas stayed with patients in theatre, they may hold patients' hands to ensure their emotional feeling explain the progress and show the babies to patients as soon as possible. Maternal-infant skin-to-skin contact can start as soon as possible. Nurses should help mothers to control their excessively emotional fluctuation that can adversely impact on the uterine contraction (7). Experts should give the information to patients and help them

to minimize negative feelings of their personal failure, if newborns are not well. Pain should be assessed and managed by anesthesiologists until 24 hours after operation.

#### Postoperative Period

Anesthetic nurse managed the postoperative pain and provided the postpartum education, such as diet, exercise, initial breastfeeding and newborn care, etc.

#### Routine Care Group (The Control C)

The routine care was implemented according to the nurses' experience and medical prescriptions (Table 3). RNs carried out the daily tasks and provided normal preoperative care. They confirmed patient's preoperative preparation and read their medical chart to obtain relevant information, but they did not provide a preoperative interview for patients the day before surgery. They provided the intraoperative care depending on nurses' experience and professional understanding to the medical protocols. Doula and other therapists were not involved in this group.

#### Data Collection and Statistical Analysis

The Visual Analog Scale (VAS) is the most frequently used approach for pain assessment. Patients are asked to choose a number to describe the pain scores, 0 represented no pain and 10 means the worst. The median scales of the control A, the experiment B and the control C were 0 (0-2), 0 (0-3) and 0 (0-2), respectively. The aim of using VAS is to exam the effect of pain relief, in order to avoid unsatisfied anesthetic effects which may

**Table 2. Preoperative Communication Checklist (Circulation Nurse Visiting Version)**

Items	Group A	Group B	Group C
Briefly Introduce the journey of surgery	√	√	-
Introduce all the members of surgical team	√	√	-
Briefly explain the epidural analgesia in common words (done by anesthetist and RN)	√	√	-
Introduce the anesthetic position and explain how to cooperate	√	√	-
Complications and precautions	-	√	-
Breast feeding and newborn care	√	√	-
Postoperative care; Information support and postpartum services for the postpartum rehabilitation	√	√	-
Promotion of wound healing	√	√	-
Influence on next pregnancy	-	√	-
Pain management	√	√	-
Provide psychological care following the guidelines	√	-	-
Provide normally emotional support	-	√	-
Provide emotional support and give the procedural information to the family member, if patient agree with this idea	√	√	-

The patients in the group C were not involved in preoperative visiting. Nurses maintained their focus on the psychological needs for the patients in the group A, the psychological support for the group A were provided according to the psycho-leaflets. In contrast, the normally emotional support was emphasized for the group B during the preoperative visiting.

have an impact on the results of the study. Pain had been relieved for all the patients during surgery according to the median scales.

### Cortisol Levels

Cortisol can serve as an important biomarker of stress, because it's associated with activation of the hypothalamic-pituitary-adrenocortical axis (HPA) that is one of the primary stress systems and responds to perceived unfamiliar situations (8). The current study examined cortisol production in 142 patients. The cortisol levels in the patients' saliva were measured by Enzyme-Linked Immunosorbent Assay (DetectX®, ArborAssays). Salivary samples were collected at different time points: 1 hour before preoperative visiting (T1), 30 minutes after visiting (T2), the moment of arriving the holding bay (T3), before implemented epidural analgesia (T4), the moment of making a skin incision (T5). A standard curve was obtained according to the kit's instructions. The sample was diluted in a 1:5 with the provided Assay buffer of which 50 µl was drawn into a clear microtiter plate coated with an antibody to capture mouse IgG. Then a 25 µl of cortisol-peroxidase conjugate was added into the wells and followed by adding 25 µl monoclonal

antibody to cortisol to each well and incubated for 1 h at room temperature. The plate was washed 4 times with washing buffer and 100 µl of tetramethylbenzidine substrate was added. 30 minutes later, the reaction was stopped by adding 50 µl stop solution. The intensity of the generated color is detected in a microtiter plate reader. The concentration of the cortisol in the sample was calculated by suitable correction for the dilution of the sample.

### The Satisfaction Score

The range of score: from 0 complained to 100 fully satisfied. The trained scout nurses interviewed patients three days after surgery, and RN should reassess patients post-operatively by asking questions about their feelings. Patients may fill out the feedback, including patients self-rated scores for the perioperative care and suggestions for improvement of nursing care.

### Data Analysis

Data were analyzed by using the GraphPad Prism version 5.0. In the univariate analysis, the Chi-square test and independent t-test method were adopted to assess the differences of the mean value of categorical and

**Table 3. Care Interventions for Each Group during and After Surgery**

Items	Group B	Group A & Group C
Promote biologic bonding	√	-
Emotional support	√	-
Pain management	√	√
Newborn care	√	√
Facilitate breastfeeding	√	√
Postoperative education	√	-
Doula service and alternative therapies: such as postpartum yoga, follow-up services	√	-
Skin-to-skin contact	√	√
Maternal adaptations	√	-

The routine care that was implemented for two control groups focused on pain management and baby care. Interventions for the experiment B included the promotion of beneficial hormonal action, patient-centered services and alternative therapies.

continuous variables, respectively. The data are presented as Means  $\pm$  SD. Mann-Whitney U test was used in analyzing non-normally distributed variables and presented as the median (interquartile ranges) (IQRs), including gestational age and VAS sales. A P value of  $< 0.05$  was considered statistically significant.

## RESULTS

### Sample Selection

This was a randomized, double-blind, controlled study. A total of 180 patients were assessed for eligibility. 38 of them were excluded for different reasons which showed in **Figure 1**. A total of 142 patients undergoing the cesarean procedure were randomly divided into three groups: Single intervention group (The control A) (n = 47), Collaborative care group (The experiment B) (n = 47) and Routine care group (The control C) (n = 48). **Table 1** shows no statistical difference in demographic data, vital signs and baseline concentrations of salivary cortisol among three groups.

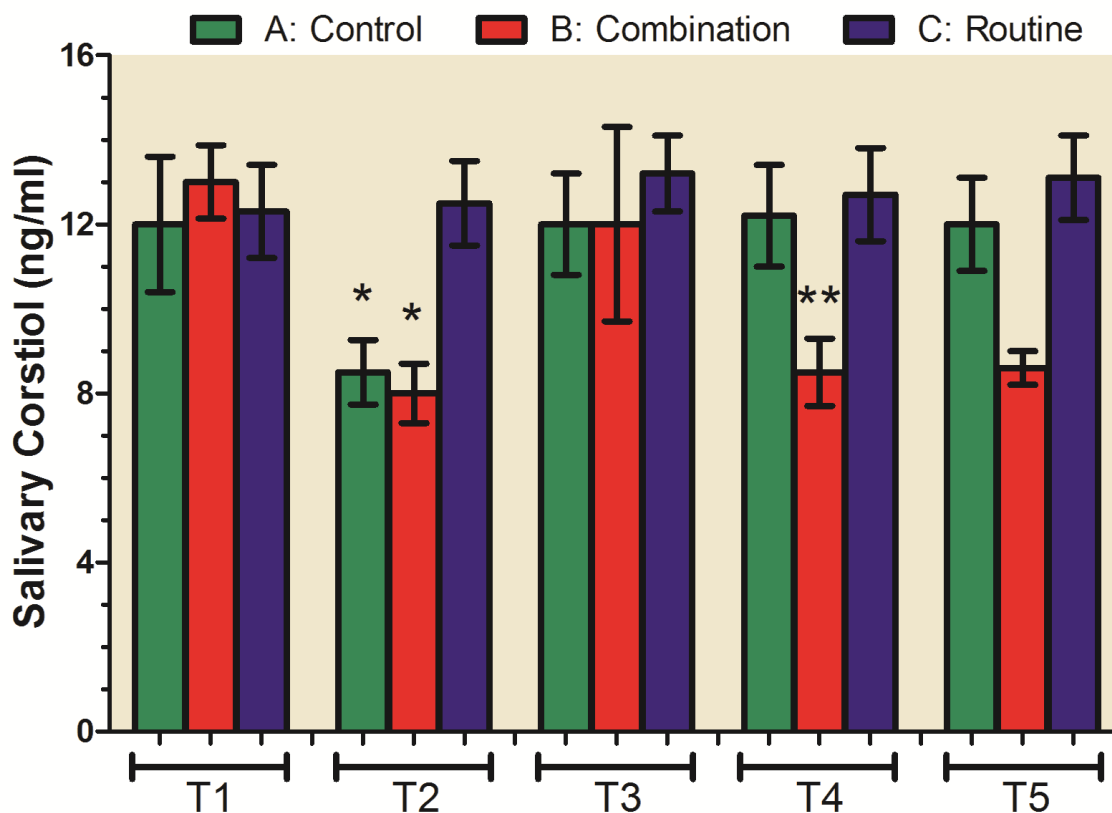
### Outcomes

This paper included only randomized controlled trials with salivary cortisol production as the primary outcome and satisfaction scores as the secondary outcome.

### Cortisol Level

Physiological stress can be indicated by salivary cortisol levels (9). Perioperative interviews showed a positive impact on the patients' stress, no matter it was normally emotional support or a psycho-leaflets visiting, patients in both the control A group and the experiment B group felt relaxed and no worries after nursing staff visited them. This phenomenon explained the salivary cortisol level of patients in the control A and the experiment B group were obviously lower than patients in the control C group ( $P < 0.05$ ), who were not visited at all during the perioperative period. The patients in the experiment B exhibited the lowest cortisol production during the surgery ( $P < 0.05$ ). In the **Figure 2**, it has been shown that the cortisol level of the experiment B was the highest among three groups one hour before visiting, and started to decrease after patients had been visited, since then; the cortisol production of this group maintained the lowest among three groups during surgery. This fluctuant trend of cortisol levels can indicate that interventions provided for the experiment B can remarkably reduce the stress-related hormone cortisol elevation, therefore, it can be speculated that interventions for the B group are able to facilitate patients to deal with their stresses throughout the perioperative stage. As shown in the same chart (**Fig. 2**), cortisol levels of the control A had decreased 30mins after visiting ( $P < 0.05$ ), however, there is no statistic difference in the cortisol production between the control A and the control C on their surgery days. These figures can illustrate that psycho-



**Figure 2. Salivary Cortisol Levels**

Single intervention group (the group A), Collaborative care group (the group B) and Routine care group (the group C). One hour before visiting (T1), 30 minutes after visiting (T2), the moment of arriving the holding bay (T3), the time before implemented epidural analgesia (T4), the moment of making a skin incision (T5).

\*: indicates a significant difference from the group C ( $P < 0.05$ ). The cortisol productions of the group A and the group B reduced 30 minutes after visiting and were significantly lower than those of the group C.

\*\* indicates a significant difference from the group A and group C ( $P < 0.05$ ). The cortisol levels of the group B were the lowest among three groups before implemented epidural analgesia.

leaflets visiting can significantly reduced patients' cortisol production, but visiting cannot maintain long-term effect, and staff may need some backup strategies to keep patient calm and relax.

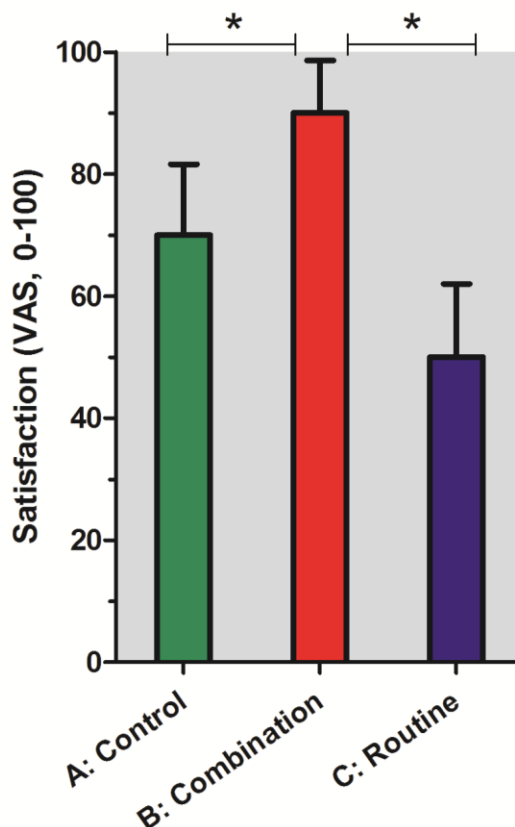
### Satisfaction Scores

**Figure 3** shows a comparison of the satisfaction scores among three groups. The mean score of control A was 70 ( $70 \pm 12$ ), the experiment B was 90 ( $90 \pm 7$ ), and 50 ( $50 \pm 13$ ) was for the control C.  $P < 0.05$  can be considered significant. The score of experiment B is significantly higher than those of the control groups. The patients of this group felt that interventions can meet their

needs, so they got greatest satisfaction among three groups.

### DISCUSSION

This study is performed to explore the impact of collaborative care on the patients undergoing c-section by using saliva cortisol measurement and self-report satisfaction score. The results showed that cortisol levels of the experiment B decreased after the interventions were implemented. The mean satisfaction score of this group was the highest among three groups. It can be demonstrated that collaborative care provided for this group

**Figure 3. Comparison of Patients' Satisfaction Score among the Three Groups**

Single intervention group (the group A), Collaborative care group (the group B), Routine care group (the group C).

\*:The mean score of the experiment B group is the highest among three groups,  $P < 0.05$  can be considered significant difference.

can make patients feel relaxed. From the postoperative interview, we found that there are three main reasons for what make patients feel stressful, which include worrying about the uncertain future, untrusting patient-nurse relationship, and immersing self in negative thinking. Most patients worried about that they may get hurt, and they worried about fetus wellbeing and self-wellbeing. The unknown environment of OR increases their unsafe feelings.

The major purpose of preoperative visiting is to reduce patient's unsafe feelings and increase their confidence to face the future in a positive way (4), for examples, we explained the procedure in common words, introduced the members of surgical team and explained the journey of surgery to make patients familiar with unknown things. Nurses may build up the trusting relationship with patients through communication (4), so that patients may feel safe and no worries, they believe

that you will do your best for them. Patients felt fully relaxed at that time. This was the reason why the cortisol levels of the control A and the experiment B started to decrease 30mins after patients had been visited. People can see the same issuer and draw the different conclusions. Only a short talk, it's difficult to change the patients' negative thinking, but nurses can draw patients' attention shifting from the stressor to an interesting talk, in order to stop patients focusing on the stressful events and negative sides (6). Collaborative care, such as alternative therapies and comfort measures from other interdisciplinary teams can ensure patients to make a choice depending on their preferences. Doula accompanied with the patients throughout the surgical journey. They can identify the patients' needs in time and distract them from the unnecessary worries through communication. Concentrating on the hobby can reduce stress and alleviate painful feelings. This is the reason



why nurses encourage the patients to do some readings or enjoy music in the holding room. All the interventions listed above assist patients in the experiment B went through the surgical journey smoothly.

When patients came into the OR, a lot of things may raise their new concerns. Without other special strategies to keep patients relax, preoperative visiting, this single intervention for the control A would diminish its effect on reducing stress along with the time, therefore, as shown in **Fig. 2**, there was no statistic difference in the cortisol levels between the control A and the control C on the surgery day, we only implemented the routine care for these two groups without any special interventions at that time.

Although we try to keep results accurate, there are still some limitations which need further effort. The changes of oxytocin concentrations in the serum can create an impact on the stress responses (1, 10). The infant may induce patient's different feelings and skin-to-skin contact may suppress the secretion of cortisol (1, 10), therefore, we only collected saliva samples before the infant was born. The perioperative pain had been relieved in this study; hence the results were not influenced by the different anesthesia performances. Some limitations should be addressed in the future study.

Firstly, this was a double-blind study, but nurses may notice which group the patients were involved in, because doula and medical therapist may offer their helps only for the experiment B, and the control C did not need nurses visiting as well. Secondly, we use the satisfaction scores to improve the results; however, some medications still can have an impact on the patients' hormone. Finally, another limitation in this study is that the care interventions are not thoroughly patient-centered and individual style. Nurses can carry out some fully personalized individual plans. Patients may be more sensitive to those interventions. Some strategies that could significantly improve our results will be added in the future study.

## CONCLUSION

The current study indicates that collaboration between multidisciplinary teams may continually create a positive impact on patients' feelings. Care plans of collaborative group are carried out from holistic aspects, therefore, interventions can meet patients' needs and patients can be fully satisfied. ■

## ARTICLE INFORMATION

**Author Affiliations:** Department of OR, Nanjing Maternity and Children Health Hospital, Nanjing Medical University, No.123, Tianfei Xiang, Mochou Road, Nanjing 210004, Jiangsu, China.

**Author Contributions:** Dr. Dong Ying Fu had full access to all of the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis.

*Study concept and design:* Fu.

*Acquisition, analysis, or interpretation of data:* All authors.

*Drafting of the manuscript:* Jiang, Wang, Guo.

*Critical revision of the manuscript for important intellectual content:* Fu.

*Statistical analysis:* Jiang, Wang, Guo.

*Obtained funding:* Fu.

*Administrative, technical, or material support:* Fu.

*Study supervision:* Fu.

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