International Journal of Surgery 34 (2016) 6–9

Contents lists available at ScienceDirect

International Journal of Surgery

journal homepage: www.journal-surgery.net

Original Research

Clinical evaluation of balloon occlusion of the lower abdominal aorta in patients with placenta previa and previous cesarean section: A retrospective study on 43 cases

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HIGHLIGHTS

- We investigated the efficacy of balloon occlusion of the lower abdominal aorta in patients with pernicious placenta previa.
- Patients treated with conventional cesarean section were controls or with preset abdominal aorta balloon as study group.
- The blood loss, transfusion of red cell suspension and the percentage of uterus resection in the study group were lower.
- The percentage of uterine cavity filling in the study group was higher.
- The balloon occlusion of low abdominal aorta seems effective in reducing postpartum hemorrhage.

ARTICLE INFO

Article history:
Received 29 June 2016
Received in revised form
10 August 2016
Accepted 15 August 2016
Available online 18 August 2016

Keywords:
Cesarean section
Balloon occlusion of the lower abdominal aorta
Placenta previa
Placenta accrete
Postpartum hemorrhage

ABSTRACT

Background: This study investigated the efficacy of balloon occlusion of the lower abdominal aorta in cesarean section surgery for the patients with placenta previa and previous cesarean section.
Methods: The patients who had placenta previa and underwent cesarean section (CS) were evaluated. The patients treated with CS to terminate the pregnancy were used as control group (23 cases); the patients treated with the preset abdominal aorta balloon before CS was taken as study group (20 cases). The investigated indicators included the intraoperative blood loss, blood loss within postoperative 24 h, the transfusion amount of red cell suspension (RCS), hospital stay, incidence rate of disseminated intravascular coagulation (DIC), the asphyxia, premature delivery and the mortality of the newborns.
Results: The two groups are comparable. The intraoperative blood loss, blood loss within postoperative 24 h, the transfusion amount of RCS and the percentage of uterus resection in the study group were significantly lower ($P < 0.05$) than that in the control group. The percentage of uterine cavity filling with ribbon gauze in the study group was higher than the control group ($P < 0.05$).
Conclusions: The balloon occlusion of lower abdominal aorta seems effective in reducing postpartum hemorrhage and the blood transfusion and decreasing the risk of hysterectomy without harming the newborns.

1. Introduction

Placenta previa is the condition that the placenta obstructs the internal orifice of cervix partially or completely where the placenta lies in the lower uterine segment [1–3]. Placenta previa is a high risk factor for post-partum hemorrhage and maternal morbidity in subsequent gestations, especially for the woman with previous uterine surgery, including cesarean section (CS) history. Placenta previa can have serious adverse consequences like morbidity and mortality for mothers and babies, antenatal and intrapartum hemorrhage, preterm delivery and emergency hysterectomy [4–7].

More and more pregnant women have CS these days. However, there is an increasing risk of placenta previa in the subsequent pregnancy after CS delivery at first birth and the risk of placenta previa in a pregnancy after a CS delivery has been reported to be

Abbreviations: CS, cesarean section; RCS, red cell suspension; DIC, disseminated intravascular coagulation; ARF, acute renal failure.

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http://dx.doi.org/10.1016/j.ijsu.2016.08.016
1743-9191/

1.5–6 times higher than that after a vaginal delivery [8]. If CS rates continue to increase, the annual incidence of placenta previa, placenta accreta, and maternal death will also rise substantially [9]. The incidence rate of placenta previa increases markedly with the raise of CS rate in recent years. Fatal haemorrhage easily occurred during the operation due to placenta previa which is often combined with the placenta accreta. In routine clinical practice, a few surgical options are performed to treat homeostasis, reduce bleeding and to retain the patients' uterus and fertility. For example, the need for transfusion of blood products is frequent, and the hysterectomy is sometimes required to control life-threatening hemorrhage, which induces the physical and psychological trauma and influences the living quality. Besides, the current surgical options are performed only after the delivery, which is disadvantageous. A preventive approach before the delivery probably will benefit the patients.

One method for reducing blood loss during the delivery is the placement of arterial occlusion balloon. However, a recent research indicated that the occlusion of the uterine arterial flow by intraoperative ligation did not achieve sufficient hemostasis because hemorrhage occurred mainly in the branches of the external iliac arteries [10–12]. This study retrospectively evaluated the clinical efficacy of balloon occlusion of the lower abdominal aorta in patients with placenta previa and previous cesarean section, with the patients who had not underwent balloon occlusion of the lower abdominal aorta as controls. The intraoperative blood loss, blood loss within postoperative 24 h, the transfusion amount of red cell suspension (RCS), hospital stay, incidence rate of disseminated intravascular coagulation (DIC), the asphyxia, premature delivery and the mortality of the newborns were investigated and compared between the two groups.

2. Patients and methods

This study was approved by the Ethic Committee of the hospital and the signed informed consent was obtained from each patient. The clinical data of the patients with placenta previa who underwent CS between January 2012 and December 2014 were retrospectively evaluated. The inclusion criteria were placenta previa diagnosed by color doppler ultrasound or magnetic resonance imaging (MRI), a medical history of caesarean section and patients without other obstetric diseases. The patients treated with CS to terminate the pregnancy were taken as the control group; the patients treated with the preset abdominal aorta balloon before CS was used as the study group.

2.1. Treatment methods

For the control group, the patients were treated with the CS to terminate the pregnancy. After the delivery, patients were injected with the uterotonic into the uterus immediately. The hysterectomy was performed unhesitatingly without stripping the placenta if large part of the placenta invaded into the serosa. If there was no obvious placenta increta, the placenta was stripped promptly and the wound bed was stitched with medical suture and stitched up like the shape of "8". When there was shallow placenta accreta with the accrete area less than 1/3, the accreta part and the associated mesometrium was cut off in wedge-shape. If hemorrhage was not stopped, the uterine artery ligation or uterine cavity filing with ribbon gauze was performed. Hysterectomy was performed when hemorrhage was beyond control.

For the study group, the abdominal aortic balloon was preset before CS. After local anesthesia, the balloon catheter was inserted into the abdominal aorta employing the Seldinger puncture technique through the right femoral artery approach. The catheter was placed below the renal artery. The contrast agent (7–8 ml) was injected and fulfilled the balloon. The volume of the injected contrast agent was recorded. The puncture site was bandaged and precisely marked. The catheter was fixed and filled with heparin solution for anticoagulation and standby application. And then CS was performed in the same way as the control group. During the CS, the uterine wall was cut open meanwhile the same dosage (according to the record of the injected contrast agent) of normal saline (NS) was injected to fill the balloon for blocking the blood supply. The fetus was delivered promptly. The hysterectomy was performed unhesitatingly without stripping the placenta if large part of the placenta invaded into the serosa. If there was no obvious placenta increta, the placenta was stripped promptly as described above in the control group. If there was not obvious bleeding, the balloon was discharged to recover the blood supply; the wound was closely observed. If there was massive hemorrhage, the balloon was deflated and the following measures: hemorrhage area suturing, uterine artery ligation, uterine cavity filling with ribbon gauze. Hysterectomy was carried out if hemorrhage was beyond control. Postoperatively, the deflated balloon was retained for 2~4 h and then the catheter was removed when there was absolutely no bleeding. The puncture was bandaged with pressure. The lower right limb was not allowed to move much. The temperature of the feet, the pulse of the arteria dorsalis pedis and the urination were monitored closely. Color doppler ultrasound was performed in the lower right limb to examine if there was thrombus.

2.2. Investigated clinical characteristics

The investigated clinical characteristics include the intraoperative blood loss, blood loss within postoperative 24 h, the transfusion amount of RCS, hospital stay, incidence rate of DIC. Besides, the asphyxia, premature delivery and the mortality of the newborns were also evaluated.

2.3. Statistical analysis

This clinical data were analyzed by the SPSS 19.0 software (SPSS Inc., Chicago, Illinois). The categorical data were expressed as number/proportion and analyzed by X^2-test. The continuous variables were expressed as mean ± SD and analyzed by *t*-test. $P < 0.05$ was considered statistically significant.

3. Results

Forty-three cases met the inclusion criteria and completed the surgery. There are 23 cases in the control group and 20 cases in the study group. The age, gestational weeks, pregnancy times, CS times, interval CS period and the percentage of placenta accreta have no statistical difference ($P > 0.05$) between the study group and the control group. The two groups are comparable. The characteristics of the patients are shown in Table 1.

In the study group, the radiation-exposed time was 45–100s (average 71.8 ± 18.5s) for placing the balloon. The total radiation volume was 33–71 mGy (average 52.85 ± 11.3 mGy). The total balloon-blocking time was 25–55 min (average 36.95 ± 7.42 min).

The intraoperative blood loss, blood loss within postoperative 24 h, the transfusion amount of RCS and the percentage of uterus resection in the study group were lower than that in the control group with significant difference ($P < 0.05$). The percentage of uterine cavity filling with ribbon gauze in the study group was significantly higher than that in the control group ($P < 0.05$) (Table 2). As for the surgery time, hospital stay, DIC incidence rate, the mortality rate and neonatal asphyxia rate of the newborns and the premature delivery rate, there was no significant difference