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Original Article

Observation of the curative effect of uterine compression suture for treatment of post-partum hemorrhage

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Abstract: Objective: To investigate the clinical efficacy of U-type uterine compression suture in the treatment of post-partum hemorrhage. Methods: A total of 80 patients with post-partum hemorrhage caused by uterine inertia treated in Jining No. 1 People's Hospital from January 2015 to December 2016 were selected for this clinical research. According to the method of hemostasis, patients were divided into group A (experimental group) and group B (control group), with 40 patients in each group. Group A adopted U-type uterine compression suture. Group B adopted conventional hemostasis treatment (including pressing uterine for hemostasis and injection of oxytocin and if ineffective, further implemented intra-uterine gauze packing). Patients' post-operative conditions (uterine contraction and post-operative bleeding), related complications (uterine incision dehiscence, fluid dark area), duration of lochia and menstrual status (menstrual volume and menstrual cycle) between group A and B were compared and investigated. Results: In group A, there were 38 cases of effective hemostasis and 2 failure cases bleeding successfully stopped by adjuvant therapy. There was no case of hysterectomy in group A, and the effective rate of hemostasis was 95%. In group B, there were 32 cases of effective hemostasis, 3 failure cases bleeding successfully stopped by adjuvant therapy, and the other 5 failure cases included hysterectomy. The effective rate of hemostasis in group B was 80%. The hemostatic efficiency rate and uterine retention rate in group A were significantly higher than those in group B (both $P<0.05$). The duration of lochia in group A and group B were 32.575±2.908 days and 32.686±3.297 days, respectively. There was no statistical difference in the duration of lochia between the two groups ($P>0.05$). The ratio of prenatal and post-partum menstrual volume in patients of group A was 1.040±0.105, and there was no case of abnormal menstruation. The ratio of prenatal and post-partum menstrual volume in patients of group B was 1.010±0.229, with 2 cases of abnormal menstruation. There was no statistical difference between the two groups of data ($P>0.05$). Conclusion: Compared with conventional treatment of post-partum hemorrhage, U-type uterine compression suture is significantly effective in the treatment of post-partum hemorrhage caused by uterine inertia, which can effectively improve the hemostatic effect and increase the uterine retention rate of patients. U-type uterine compression suture has the advantages of better post-operative recovery, no obvious abnormality in lochia and menstruation, and its high operability makes it easy for clinical promotion and application.

Keywords: Uterine compression suture, post-partum hemorrhage, post-operative recovery, complications

Introduction

Primary post-partum hemorrhage (PPH) is a serious perinatal complication, which is defined as total blood loss of more than 500 mL within 24 hours after vaginal delivery of the fetus and more than 1,000 mL during caesarean section [1, 2]. PPH is still the leading cause of maternal death worldwide, accounting for over 25% of maternal mortality, while the incidence in developing countries is higher than that in developed countries [3-5].

Most conservative treatments for PPH, such as uterine fundus massage or uterine compression, use of various types of ocytocic agents and intra-uterine gauze packing or intra-uterine balloon catheter, could control most of the post-partum hemorrhage conditions [3]. However, after the failure of conservative treatment, traumatic treatment methods will be introduced, including uterine artery ligation, iliac artery ligation, and even hysterectomy [6]. Post-partum hysterectomy in emergencies is a surgical method to save lives, but it will lead to uri-

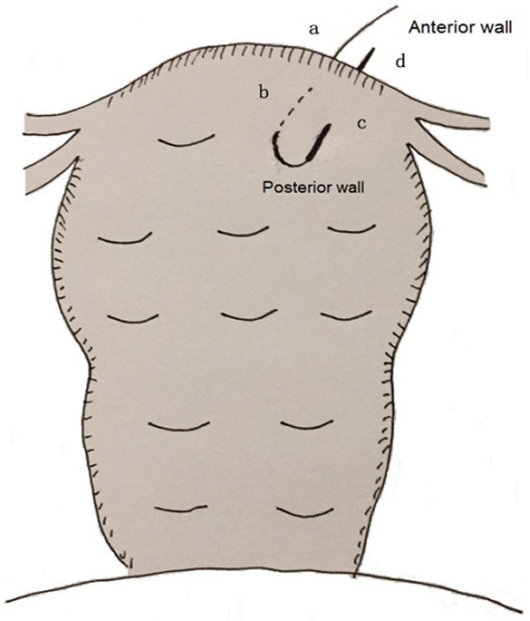

Figure 1. Sample graph of uterine compression suture. Needle was inserted from the serous layer of anterior uterine wall (location a), penetrated the uterine cavity and then the needle was exited from posterior wall of the uterine serosa (location b). The second needle insertion point was about 2 cm from the first needle exit point, inserted needle from the posterior wall (location c), again penetrated the uterine cavity and then the needle was exited from anterior wall (location d), and then knotted tightly.

nary system damage, ovarian failure, loss of fertility, great psychological trauma and even death and other adverse consequences [7, 8]. In 1997, B-Lynch et al. introduced B-Lynch uterine compression suture, which could effectively preserve the uterus and fertility. B-Lynch suturing is mostly suitable for bleeding caused by uterine fibrotic systolic dysfunction, and it is an extremely effective surgical method for PPH caused by uterine inertia [9, 10]. Recent studies show that adoption of this method leads to high complications such as post-operative uterine adhesions [11-13]. Additionally, various modified uterine compression suture methods have been developed for different PPH etiologies (such as Cho suture, Hayman suture, Zheng suture, etc.), but each has its own limitations and the occurrence of late complications [14, 15]. This research introduced the suturing method of U-type uterine compression suture [16]. This method is more rapid for hemostasis and easier to operate. In order to reduce the occurrence of late complications, the easily absorbable MONOCRYL surgical sutures have been used, which have a smaller tissue response than the gut. On the one hand, it is smoother than the gut and the tissue dragging is even more minor. The flexibility of the material is good, and the suture can still maintain integrity after passing through the tissue several times, which can adequately support the hemostatic effect of the tissue. On the other hand, with the gradual digestion of absorbable sutures, later compression of the uterus can be alleviated and late severe complications can be avoided.

The main causes of PPH include uterine inertia, placental factors, soft birth canal laceration and coagulation dysfunction, of which uterine inertia and placental factors are the most common causes [17-19]. This research selected patients with post-partum hemorrhage caused by uterine inertia as research subjects, to investigate the clinical hemostatic effect, post-operative recovery, and incidence of complications of U-type uterine compression suture in the treatment of PPH caused by uterine inertia, so as to provide a clinical basis for the further promotion and application of U-type uterine oppression suture.

Materials and methods

General information

A total of 40 patients with post-partum hemorrhage caused by uterine inertia treated with U-type suture in Jining No. 1 People's Hospital from January 2015 to December 2016 were selected as group A (experimental group). According to the matching method of 1:1, 40 patients who received conventional treatment in the same period were selected as group B (control group). The age of the selected patients ranged from 25 to 32 years old.

Inclusion criteria: Blood loss more than 500 mL within 24 hours after vaginal delivery of the fetus and more than 1,000 mL during caesarean section [2]; patients with post-partum hemorrhage caused by uterine inertia.

Exclusion criteria: Advanced maternal age (≥35 years); patients with a history of adverse pregnancy outcomes; patients with a history of post-partum hemorrhage; patients with abnormal coagulation function.

Table 1. Comparison of general data between two groups of patients

Group	Case	Average age	Average gestational weeks	Delivery methods (case)	
				Cesarean section	Vaginal delivery
Group A	40	28.575±2.086	38.975±1.230	22	18
Group B	40	28.775±1.954	39.025±1.368	21	19
t/X^2		-0.422	-0.172	0.050	
P		0.553	0.585	0.823	

Note: Group A, experimental group; group B, control group.

Table 2. Comparison of the clinical hemostatic effect of two groups of patients

Group	Effective case/invalid case	Effective rate	The number of cases of hysterectomy after failure (n, %)
Group A	38/2	95.0%	0
Group B	32/8	80.0%	5 (12.5)
X^2		4.114	5.333
P		0.043	0.021

Note: Group A, experimental group; group B, control group.

This study was approved by the Medical Ethics Committee of Jining No. 1 People's Hospital, and the patients and their families signed the informed consent.

Methods

Group A adopted the modified U-type uterine compression suture method, using a single-bridge MONOCRYL absorbable suture which is easy to absorb and in good flexibility. Its hemostatic effect and reduction of tissue reaction to foreign bodies was comparable to non-absorbable sutures, while reducing the potentially harmful consequences of long-term oppression. The suture was placed at the bottom of the uterus and 6-12 horizontal U-shaped sutures were made from the fundus to the cervix. The number of sutures was determined by the size of the uterus, the location of bleeding, and the continuous bleeding status. For the specific U-type sutures method, a needle was inserted from the serous layer of anterior uterine wall (**Figure 1**, location a), penetrating the uterine cavity. The needle was then exited from the posterior wall of the uterine serosa (**Figure 1**, location b). The second needle insertion point was about 2 cm from the first needle exit point, with the inserted needle entering the posterior wall (**Figure 1**, location c) and again penetrating the uterine cavity. The needle was then exited from the anterior wall (**Figure 1**, location d), and then knotted tightly. (See **Figure 1**, suture example diagram). When suturing, attention was paid to the intensity of tightness. Too loose or too tight affected the treatment effect. The maximum strength was to achieve effective pressure to stop bleeding.

Group B was treated by a conventional hemostasis method, including uterine compression, massage hemostasis, injection of oxytocin, and further intra-uterine gauze packing was applied while conventional hemostasis treatment was ineffective. The specific treatment methods included the midwife's left fist against the patients' front wall of the uterus, and pressing the back wall of the uterus from the abdominal wall by the right hand to let the uterine body become anteflexed. The uterus was tightly pressed with both hands, and regularly massaged until the uterus restored normal contraction. At the same time, 10 units of oxytocin was slowly injected into the wall of the uterus, and another 10 units of oxytocin mixed with 5% glucose was continuously intravenously dripped. For those with poor uterine contraction, 50-200 mg of misoprostol tablets were given orally. When conventional methods failed to promote uterine contraction and hemostasis, uterine gauze packing compression was applied immediately to stop the bleeding. The gauze was soaked with disinfectant solution and stuffed in the cervix in an orderly manner from the fundus. After 24 hours, the gauze was taken out and misoprostol was given orally before taking out the gauze. A total of 10 units of oxytocin were intramuscularly injected every 6 hours on the day of surgery, and the following day was changed to intramuscular injection every 8 hours. Adjuvant treatment of post-operative complications: the single muscle injection of carboprost tromethamine was used to control bleeding.

Table 3. Comparison of post-operative duration of lochia in two groups (day)

Group	The duration of lochia
Group A	32.575±2.908
Group B	32.686±3.297
t	-0.155
P	0.374

Note: Group A, experimental group; group B, control group.

Observation indexes and effect determination

Main outcome measures: 1) any abnormal uterine contractions; 2) post-operative hemostatic conditions; 3) post-operative complications conditions; 4) whether to effectively retain the uterus.

The post-operative state of group A and B was investigated comparatively, including uterine contraction, post-operative hemostatic and complications [20]. For the clinical efficacy evaluation, when the uterus was gradually contracted, no bleeding in the incision, no obvious hematocele in the vagina, or no complication occurs, then the method was deemed as effective. Otherwise, it was considered invalid [20]. Effective rate = effective number of patients/total number of patients * 100%.

Secondary observations: 1) duration of lochia; 2) recovery of menstruation.

Evaluation of post-operative return visit indicators: 1) patients were reviewed at the obstetric clinic on post-delivery 42 days, and the duration of lochia in group A and B was compared; 2) randomly selected 20 cases of menstrual recovery patients from each group, and their menstrual conditions including menstrual volume and menstrual cycle were followed-up for 3 months after stopping breastfeeding. Calculation of menstrual volume was based on the pre-natal menstrual volume as the reference value 1, and the multiple value of post-operative menstrual volume compared with prenatal menstrual volume was obtained. Therefore, the post-operative volume/prenatal volume. The relative values were given by patients according to their own menstrual volume.

Statistical methods

SPSS19.0 statistical software was used for statistical analysis. The measurement data are expressed as mean ± standard deviation ($\overline{x}$ ± sd). A t-test was used to compare the normal distribution of inter-group measurement data, which was represented by t. The count data are expressed as a percentage (%) and analyzed using Chi-square test and Fisher's exact probability method, expressed in Chi-square. $P<0.05$ indicates that the difference is statistically significant.

Results

Comparison of general data between two groups of patients

The general clinical data such as average age of the two groups of patients were compared and are shown in **Table 1**. There was no statistical difference in average age, average gestational weeks and delivery methods between the two groups (all $P>0.05$). The data of clinical research were comparable.

Comparison of post-operative state of two groups of patients

Group A (n = 40) underwent U-type uterine compression suture treatment, including 38 patients with excellent uterine contraction, no incision dehiscence, no bleeding phenomenon, and no obvious hematocele in the vagina, which was considered as effective, with an effective rate of 95%. There was a liquid dark area in 2 patients by B-ultrasound examination, which were considered invalid. Successful hemostasis was achieved after adjuvant therapy for these two patients, and there were no hysterectomy cases in group A.

Group B (n = 40) received conventional hemostasis treatment. Among 32 patients, those that had good uterine contraction, no incision dehiscence, no bleeding phenomenon, and no obvious hematocele in the vagina, were considered as effective, with an effective rate of 80%. Three patients still had a small amount of bleeding after surgery, and hemostasis achieved after adjuvant therapy. The other 5 patients underwent hysterectomy after conservative treatment failed, and the bleeding was stopped and no death case after hysterectomy. Comparison between the two groups is shown in **Table 2**.

The clinical hemostatic effects of group A and group B were compared and analyzed by Chi-square test, and P = 0.043 indicated the sta-

Table 4. Comparison of menstrual recovery in two groups

Group	Case	Menstrual volume	The proportion of cases in patients with abnormal menstruation
Group A	20	1.040±0.105	0.0%
Group B	20	1.010±0.229	10.0%
t/X^2		0.533	2.105
P		0.173	0.487

Note: Group A, experimental group; group B, control group.

tistical significance of hemostasis efficiency comparison. Comparison of the rate of hysterectomy between the two groups, and P = 0.021 showed that the difference was statistically significant. It demonstrated that uterine compression suture treatment had a better clinical hemostatic effect and reduced the risk of hysterectomy.

Comparison of post-operative duration of lochia in two groups

The comparison of the post-operative duration of lochia in group A and B is shown in **Table 3**. The duration of lochia in group A and group B were (32.575±2.908) days and (32.686± 3.297) days, respectively. There was no statistically significant difference between the two groups, P = 0.374.

Comparison of menstrual recovery in two groups

The menstruation conditions, including menstrual volume (with prenatal menstrual volume as reference value 1, calculating the multiple value of post-operative menstrual volume) and menstrual cycle of two groups of patients 3 months after stopping breastfeeding, were followed-up. The comparison of menstrual recovery conditions in two groups is shown in **Table 4** and **Figure 2**.

There was no statistical difference in the proportion of cases in patients with abnormal menstrual volume and menstruation. Compared with group B, the overall situation of menstrual volume in group A was close to the amount of menstrual volume before delivery.

Discussion

U-type uterine compression is an improved method based on B-Lynch suture, and easier to operation. The principle of U-type uterine compression suture is based on the method of surgical suture to mechanically extrusion the uterus, by physically pressing the blood vessels inside the uterus to reduce its blood flow. Additionally, the local ischemia of the myometrium can effectively promote the intensification of uterine contraction and form a thrombus to achieve hemostasis [9]. In the case of severe uterine inertia, the prompt use of uterine compression suture to stop bleeding is an effective surgical method to control the deterioration of PPH, thereby to avoid the necessary hysterectomy after the failure of conservative treatment, and effectively improve the patients' uterine retention rate [21-23].

In this study, the cases of post-partum hemorrhage caused by uterine inertia treated in our hospital were selected as research subjects, and the clinical efficacy of uterine compression suture and conventional treatment were compared. Among 40 cases of U-type uterine compression suture, 38 cases showed effective hemostasis, with 2 failure cases that were successfully treated by adjuvant therapy. There were no hysterectomy cases and the effective rate of hemostasis was 95%. Of the 40 patients who received routine treatment, 32 patients had effective hemostasis, 3 of failure cases were successfully treated by adjuvant therapy, and 5 failure cases were subjected to hysterectomy. The effective rate of hemostasis was 80%. There was a statistical difference in the efficiency of hemostasis and the retention rate of uterus between the two groups (both P<0.05). Compared with conventional treatment of post-partum hemorrhage, U-type uterine compression suture was effective in the treatment of post-partum hemorrhage due to uterine inertia, which can effectively improve the hemostatic effect and improve the uterine retention rate of patients. This result is similar to the results of clinical application of improved multiple U-type uterine compression sutures in intractable post-partum hemorrhage. Uterine compression suturing is based on the method of physically compressing blood vessels inside the uterus, which can effectively avoid the problem of low pressure and voids in conventional method, which leads to failure of hemostasis [3]. The result is similar to the result of the application of U-type suture in hemorrhage caused by placental factors in caesarean section. The duration of lochia in pa-

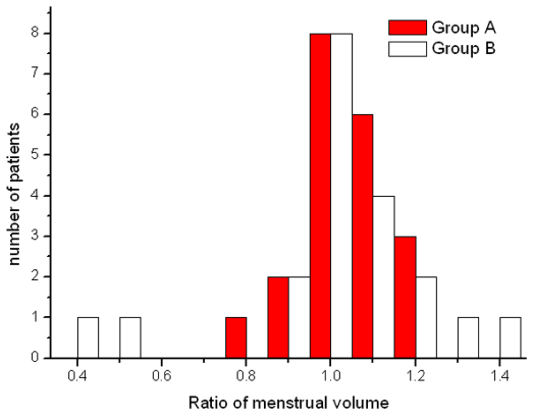

Figure 2. Comparison of menstrual volume in group A and B. Group A, experimental group; group B, control group.

tients with U-type uterine compression was (32.575±2.908) days. The duration of lochia in patients with conventional treatment was (32.686±3.297) days. There was no statistical difference in the duration of lochia between the two groups (P>0.05). Twenty patients with menstrual recovery were selected from each group. The ratio of menstrual volume in group A was 1.040±0.105 compared with prenatal menstrual volume, and there was no case of abnormal menstruation. The ratio of menstrual volume in group B was 1.010±0.229 compared with prenatal, and there were 2 cases of menstrual abnormalities. There was no statistical difference between two groups of data, P>0.05. The rate of post-partum abnormal menstruation of patients that underwent U-type uterine pressure sutures was lower than that of patients with conventional treatment method.

This study has the limitations such as small sample size and limited study time. Subsequent investigation will be continued to determine the effect of U-type uterine compression suture in the treatment of post-partum hemorrhage, and long-term follow-up will be carried out to observe the influence of U-type uterine compression suture on fertility of patients [24].

In summary, U-type uterine compression suture is remarkably effective in the treatment of post-partum hemorrhage caused by uterine inertia and it is beneficial to the retention of the patients' fertility. At the same time, uterine compression suture has high operability, good post-operative recovery, and no serious complications, which can further enhance the clinical promotion and application rate.

Disclosure of conflict of interest

None.

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