

Original Article

The effect of pre-operative autologous blood donation self-transfusion on hormone and postpartum convalescence in Lying-in women

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Abstract: The aim of the study is to investigate the feasibility of pre-operative autologous blood donation (PABD) self-transfusion on the postpartum recovery and the endocrine in lying-in women. The PABD is carried out on 70 pregnant women who have high risk of postpartum hemorrhage. Those 70 subjects were divided into three groups: 33 cases of PABD self-transfusion during the Cesarean section; 16 cases of PABD self-transfusion as a physiological means and 21 cases without transfusion. Serum levels of Estradiol (E2), Progesterone (P), Prolactin (PRL) hormone are evaluated 48 hours before and after labor; Postpartum colostrum timing, milk yield, short term and long term uterine contraction are observed among the cases. No significance were observed among the three groups on E2, P, PRL hormone 48 hours before and after labor. The PRL concentration in PABD self-transfusion group is higher than that in the group without self-transfusion 48 hours after labor. Using different PABD self-transfusion strategies, significant difference of the initial milk yield time were observed in the three groups ($F=6.035$ $P=0.004$), but the milk yield is no significant different on second day and third day. The self-transfusion of PABD has little influence on uterine contraction. For the women who underwent Cesarean Section, the PABD self-transfusion is conducive to the increase of PRL level. The PABD self-transfusion advances the commencement time of milk yield, while with little effect on neither milk yield volume nor uterine contraction.

Keywords: PABD self-transfusion, PRL, hormone postpartum puerperium, milk yield, uterine contraction involution of uterus

Introduction

The obstetrical hemorrhage is a primordial threat to the safety of the lying-in women [1, 2]. Therefore, the blood transfusion is commonly applied in the obstetrics. As the fears increase on the spread of potential infective diseases through allogenic blood products transfusion and the shortfall in blood donation supply from blood banks [3], the pre-operative autologous blood donation (PABD) becomes more and more popular form in the clinic [4]. Because of the variant factors affecting the obstetrical hemorrhage, it is hard to estimate the timing and the volume of hemorrhage after the labor process before it starts. According to some reports, the wastage of unneeded PABD units varies from 18% to above 50% [5-7]. For Cesarean section, the hemorrhage volume during the common operation is less than 500 ML, it

is no need to resort to PABD self-transfusion with regard to the indication of blood transfusion. For the would-be lying-in women undergone PABD, their hemorrhage risk is greater than that of the general lying-in women, but judging from the blood transfusion indications, there exists still large amount of PABD remaining in idle. Is it possible to transfuse the idle PABD as a means of additional nutrition back to the lying-in women? The correlated systematic research on this respect remains to be conducted. Whether the blood from the PABD self-transfusion could be used as nutritional supplement in the lying-in women remains unknown.

The obstetrical PABD blood in general is collected during 32-37 gestational weeks, when the estrogen and progesterone hormone concentrations in blood are 150-250 fold of those at 48 hours after labor. After the placental

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expulsion, estrogen and progestational hormone concentrations decreased rapidly [8]. The E2 level at 48 hours after labor gets close to its follicular phase level. Progestational hormone concentration also decreases quickly, but at 48 hours after labor, its concentration remains greatly higher than that at follicular phase, and it takes 15 days to reduce to the same level at the infertile follicular phase. What is the effect of the PABD self-transfusion as additional physiological supplement after labor on the puerperium hormone? Furthermore, does the hormone fluctuation affect the milk yield and postpartum recovery of the lying-in women? This study focuses on the objective evaluation, from two perspectives namely endocrine and postpartum convalescence, on the feasibility and timing of the PABD self-transfusion as a means of nutritional supplement.

Materials and methods

The present research is discussed and approved by the Ethics committee of our hospital, thus immune from any ethical contention or doubt. The 70 subjects are informed and with the consent forms signed before being enrolled in the medical scientific research project.

Subjects

The subjects are selected from the would-be mothers admitted in our hospital from September 2009 to November 2011, 22-35 years old and 33-37 weeks in gestation. The blood is collected from the patients with obstetrical hemorrhage risk, among which 47 cases of placenta prevue, 13 cases of macrodome, and 10 cases of RH negative puerpera. Depending on their hemoglobin level, 200-400 ml blood is deposited and underwent constituent separation.

Grouping and blood transfusion timing

Group 1: Cases with PABD self-transfusion during the Cesarean section. In case of the hemorrhage quantity ≥ 500 ml during the labor process or the hemoglobin level ≤ 100 g/L, PABD self-transfusion is performed during the operation with total 33 cases, among which 18 cases complete the entire research, and 15 cases fulfill postpartum convalescence observation stage.

Group 2: Cases of PABD self-transfusion as a nutritious means: In case of the hemorrhage

quantity during the labor process ≤ 500 ml, around 12 hours after labor, PAD self-transfusion is conducted with total 16 cases.

Group 3: Cases without PABD self-transfusion: As the candidates have no blood transfusion needs, they abandon the PABD self-transfusion of their own volition with total 21 cases.

Hormone samples gathering methods

The following detection and testing are carried out respectively after the blood collection, within 48 hours before and after labor: Reproductive endocrine hormone concentration detection including estradiol (E2) progesterone (P) prolactin (PRL). Before the samples are collected, there is no obstetrics check-up or breast feeding within 30 minutes. All samples were sent immediately to the laboratory where the tests are conducted after centrifuge at 3000 g for 10 min followed by blood serum separation.

Hormone detection methods

E2: The method One step SPA ELISA is performed, using ABBOTT ARCHITECT i1000 system, low value within-run precision: 5.5% CV, medium value within-run precision 1.9% CV, high value within-run precision 1.5%. The sensitivity of analysis ≤ 10 pg/ml.

P: The method One step SPA ELISA is conducted, using ABBOTT ARCHITECT i1000 system, low value within-run precision: 4.7% CV, medium value within-run precision 1.8% CV, high value within-run precision 1.9%. The sensitivity of analysis ≤ 0.1 pg/ml.

PRL: The chemiluminescence immunoassay detection method is performed, using ABBOTT ARCHITECT i1000 system, low value within-run precision: 3.5% CV, medium value within-run precision 2.8% CV, high value within-run precision 2.7%. The sensitivity of analysis ≤ 0.6 ng/ml.

Postpartum convalescence index observation

Milk yield commencement time [4] with reference to the training manual published by WHO, after the birth of the newborn, manually massage the breasts, note down the time of milk running out of the breasts.

Evaluation Criteria of milk yield, take the following factors into account: nursing times a day,

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Table 1. The general information of the candidates

Group	n	Age	gestational weeks	Gravidity	Hemorrhage volume (ml)	weight of the newborn (g)
Group 1	33	28.21±5.14	37.88±2.69	2.30±1.38	625.6±416.21	3251.31±669.71
Group 2	16	31.18±4.82	38.00±1.71	2.13±1.96	357.81±242.45	3545.00±855.70
Group 3	21	29.05±4.40	38.29±1.60	1.81±0.93	265.24±172.90	3612.38±560.31
F		2.02	0.78	0.771	2.75	2.08
P		0.14	0.48	0.467	0.08	0.133

Table 2. Hormone concentration before labor for candidates who underwent PAD self-transfusion at different timing

Group	n	E2 before labor	PRL before labor	P before labor
Group 1	18	26747.28±17129.74	344.08±116.30	218.68±78.56
Group 2	16	21719.38±8284.87	386.72±55.87	199.51±85.26
Group 3	21	19688.10±10497.48	320.53±131.21	190.19±61.68
Value F		1.58	1.67	2.27
P*		0.215	0.197	0.115

Note: P-value means E2, PRL and P statistical comparison among three groups.

sleep soundness after lactation, daily urine discharge times of the newborn when giving judgment to milk yield quality. Three days after the birth of the newborn, clinical signs as follows of the newborns were monitored and recorded: ① sufficient lactation: diurnal feeding ≥ 6 times/day; urine discharge of the newborn ≥ 6 times/day, post-lactation peace time ≥ 3 hours. ② insufficient lactation: diurnal lactation ≤ 6 times/day; urine discharge of the newborn ≤ 6 times/day, post-lactation peace time ≤ 3 hours.

Evaluation on Involution of uterus

Evaluation on short-term involution of uterus: The uterus height variation on the 1st day and the 3rd day after labor, uterus height is calculated from the upper margin of pubic bone to funds of uterus.

Evaluation on long-term involution of uterus [9]: The obstetrics recheck is conducted 42-54 days after labor to check the presence of following symptoms: postpartum persistent flow of logchip or spasmodic lochia; poor involution of uterus after bimanual examination of uterus; blood clod within the uterus or three diameters of the uterus ≥ 18 cm revealed by ultrasound diagnosis, which are led to the diagnosis of the malfunction of involution of uterus. The recheck after 42 days, no sanguinous lochia, the sum of three diameters of the uterus < 18 cm, and involution of uterus is judged good; Calculate

perfect rate of uterus involution in two groups.

Statistics

The statistical analysis of the data was conducted using SPSS 17.0 software. The results of normal distribution were represented in means \pm SD. The homogeneity of variance is calculated before the analysis of the measurement data among two groups, in case of the heterogeneity of variance, corrected t-test technique is used, otherwise, t-test is displayed; The analysis and comparison through One-way VONA among groups and that among two groups is conducted by the variance components method. The statistics of the measurement data is carried out by χ^2 detection method and Fisher precision detection method. The P value < 0.05 is indicated and considered significant.

Results

Analysis of the general conditions among three forms: the candidates conditions including their age, gestational weeks, gravidity, the weight of the newborn and hemorrhage quantity during labor process show no significant difference (see **Table 1**). However, the average volume of hemorrhage of operation refusing group is higher than those in the rest two groups.

The effect on E2, PRL, Hormone concentration level of the candidates undergone Cesarean section at 48 hours after labor by different blood transfusion timing.

After the collection of the blood in PABD, the blood samples were divided into three groups. Only 18 subjects (18/33) with PABD self-transfusion during the Cesarean section complete the observation of hormone concentration 48 hrs after labor. With evaluation of hormone con-

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Table 3. The effect on the hormone variation at 48 hours after labor by PABD self-transfusion at different timing for the patients underwent Cesarean Section

Group	n	Average blood transfusion quantity per head (ml)	E2after labor	PRL after labor	P after labor
Group 1	18	260.61±78.82	68.17±26.22	403.82±121.88	3.20±2.29
Group 2	16	250.00±89.44	99.31±41.65	376.30±73.51	3.61±2.57
Group 3	21	0.00	78.10±34.41	305.62±53.26	3.72±2.49
Value F		0.179	2.17	6.71	0.238
P*		0.674	0.12	0.003	0.79

Note: P-value means E2, PRL and P statistical comparison among three groups.

Table 4. The effect on the milk yield by different PAD self-transfusion timing

Group	n	milk yield commencement time (h)	2nd after labor		3rd after labor	
			sufficient	In-sufficient	sufficient	In-sufficient
Group 1	33	18.67±5.74	17	16	5	28
Group 2	16	13.25±3.57	6	10	3	13
Group 3	21	18.95±6.54	10	11	2	19
detection value		F=6.035	X ² =0.852		X ² =0.693	
P		0.004	0.653		0.707	

Table 5. The effect on the involution of uterus of the patients undergone Cesarean Section by the PAD self-transfusion intervened at variant timing

Group	n	short term uterus contraction			long term Involution of uterus	
		uterus height 1 (cm)	uterus height 3 (cm)	uterus height gap	Involution of uterus GOOD	Involution of uterus NO GOOD
Group 1	32	15.94±1.83	13.16±1.85	2.78±1.45	26	6
Group 2	16	16.44±2.22	13.06±2.38	3.37±1.82	14	2
Group 3	21	17.10±2.40	14.48±1.99	2.61±1.16	16	5
detection value		F=1.912	F=3.12	F=1.313	X ² =0.852	
P		0.156	0.06	0.276	0.676	

Note: The uterus height1: height of fundus of uterus for the 1st day after labor; The uterus height 3: height of fundus of uterus for the 3rd day after labor; uterus height gap = the uterus height 1-the uterus height 3.

centration among three groups, the indicators before labor like E2, PRL. Hormone concentration showed no difference ($P > 0.05$), and the concentrations of E2, P also showed little variance after labor, while the PRL concentration showed significant difference ($F=6.71$ $P=0.003$) after labor. With comparison between the groups underwent PABD self-transfusion at different timing, three kinds of hormone concentration before labor have little difference ($P > 0.05$), for the group of patients who underwent PABD self-transfusion, their PRL concentration at 48 hours after labor is much higher than that of group 3, but no significant difference between the groups underwent PABD self-transfusion at different timing (Tables 2, 3).

Among the three groups of lying-in women, milk yield commencement time exists significant difference ($F=6.035$, $P=0.004$). By adopting the comparison in pair within two groups, there is little difference for Group 1 and Group 3 ($t=0.169$ $P=0.866$), but the milk yield commencement time in Group 2 is higher than that in Group 3 ($t=3.38$ $P=0.002$). The 2nd and 3rd observations on milk yield after labor are conducted using chi-square analysis. The results showed that the milk yield in three groups has little difference ($P > 0.05$) as showed in Table 4.

The effects on uterus involution of the patients undergone Cesarean Section by the PABD self-transfusion intervened at variant timing. With regard to the results of the observation of post-

partum involution of uterus, as one case occurred that patient lost her uterus by operation and it cannot be counted in Form 1, the three indicators about short term uterus contraction are used and Single factor analysis of variance is conducted, the results of the analysis showed no difference among three groups ($P > 0.05$). And the indicators used in long term involution of uterus are evaluated by chi-square analysis, the results demonstrate no difference. For detail, as showed in **Table 5**.

Discussion

Focusing on the patients undergone Cesarean section, we investigated the effects of the different self-transfusion tactics on hormone concentrations 48 hours after labor. E2, PRL, P concentrations before labor have no significant change in three groups, and E2, P concentration 48 hours after labor have little difference, but for the Form 2, the average of E2 concentration is relatively higher than that of Form 1 and Form 3. However these results need to be confirmed by larger samples. It indicates that the self-transfusion after labor influences E2 concentration, which makes E2 decrease slowly after labor, or increases E2 level in a certain period. The reason behind this lies in PABD blood in frozen state with relative higher E2 level transfused back into its hosts immediately after the operation. The external E2 and internal E2 are disintegrated at 24 hours after labor during the peak of liver metabolism. At 24 hours after labor when the self-transfusion of PABD blood is self-transfused and the placenta is expelled, estrogen level drops sharply [10] and comes to nearly the same level of follicular phase at 48 hours after labor. The external higher concentrated E2, P are transfused back, which causes the transient rises of the serum level of E2 and P hormone.

48 hours after self-transfusion, PRL level in each of Group 1 and Group 2 is significantly higher than that in Group 3, but no difference was observed when comparing the groups that receive the blood at different timing. According to this result, the PABD blood transfused back as a means of nutrition improves, the increase of PRL concentration in the patients, as the blood transfusion itself contributes a stress response to the patients' body, and the stress response probably results in a rise of PRL level [11, 12]. This phenomenon is reported in the cord blood self-transfusion.

In terms of lactation, there is no difference on the commencement time of milking between Group 1 and group 2. The first nursing time in group 2 is shorter than that in group 1 and group 3, while the milk yield seems no difference in the 2nd and 3rd day after labor. It is still need to be verified whether it is caused by the fluctuation of PRL hormone concentration in the patients who underwent postpartum PABD self-transfusion. The *in vitro* study shows that PRL can regulate α -milk protein synthesis [13], the other research also reveals that the rise of PRL concentration is in favor of milk yield [14, 15], but it needs to investigate the quantitative relation between PRL concentration in blood plasma and milk output. The postpartum PABD self-transfusion helps put forward the first nursing time, in particular for lying-in women undergoing Cesarean section. The spiritual factor may influence the function of hypothalamus and pituitary, thus reduce or hold back the secretion of PRL, and decrease milk yield. The lying-in women who labor through vaginal delivery remain mentally stable after labor, take food and move about normally, the majority of them can let the newborn sucking and begin feeding and give the newborn sufficient nursing more earlier. Furthermore, the vaginal delivery produces strong stress response that leads to the rise of 5-hydroxytryptamine secretion, giving rise to the secretion of PRL and psilocin. Through Cesarean section implies the feeling of fear at the cut of abdomen, making the lying-in women worried, agitated and poor sleeping, led to the sympathetic stimulation. Because of the anesthesia and surgery elements, the patients undergone Cesarean section and her newborn sleep in different wards, thus postpone the first milk sucking time, that's why PRL concentration level at 48 hours after labor of the patients received Cesarean operation is lower than that of the patients engaged in vaginal delivery, therefore postpartum PAD self-transfusion makes up for this.

PAD self-transfusion helps the rise of PRL level of the patients undergone Cesarean Section, what is its role on postpartum recovery? By comparing the indicators from Group 3, Group 1 and group 2, the analysis shows the short term uterus contraction indicators except uterus height gap have little obvious change, this agrees with the conclusion by Mr Sheldon experiment on the sheep [8]. For long term uterus contraction indicators, through the che-

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ck-up at 42 days after labor, three groups have no big difference in terms of involution of uterus, which explains that PAD self-transfusion has little effect on the uterus.

In sum, the application of PAD self-transfusion in the obstetrics depends on the circumstances occurred in the Cesarean operation, in case of large quantity of hemorrhage during the operation, it needs PAD self-transfusion immediately, if not, PAD self-transfusion that could be carried out as a means of supplementary nutrition, which provided the blood quality remains acceptable.

1. Among the lying-in women undergoing Cesarean section, PAD self-transfusion promotes the rise of PRL in the patients and the advance of nursing time, but has no correlation with milk yield.

2. PAD self-transfusion as a means of nutrition may give rise to estrogen level for a certain time and E2 decrease speed slows down, but it inflicts little effect on the uterus.

Disclosure of conflict of interest

None.

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