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Clinical characteristics and referral outcomes of Chinese women with primary postpartum hemorrhage: A single-center retrospective study

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Abstract

This study investigated the clinical characteristics and referral outcomes of primary postpartum hemorrhage cases. All the postpartum hemorrhage referral cases were analyzed and divided into two groups based on blood loss: < 2500 ml and ≥ 2500 ml. Clinical features, complications, and treatments were compared. Patients with blood loss ≥ 2500 ml had significantly higher incidences of disseminated intravascular coagulation, organ dysfunction, intensive care unit admission, and longer hospital stays. Birth canal laceration was more frequently the cause of bleeding in this group (P<0.05). More aggressive interventions before referral, including uterine tamponade, B-Lynch sutures, pelvic vascular ligation, and hysterectomy, were required in the ≥ 2500 ml group (P<0.05), along with significantly greater blood product transfusion. Increasing postpartum blood loss was associated with worse maternal outcomes and higher treatment intensity. These findings emphasize the importance of early active management of postpartum hemorrhage and timely referral once the patient's condition is stabilized to improve prognosis. *(Afr J Reprod Health 2026; 30 [5]: 64-73).*

Keywords: Postpartum hemorrhage, referral, clinical characteristics, causes of bleeding, organ dysfunction, treatment

Résumé

Cette étude a analysé les caractéristiques cliniques et les issues des transferts hospitaliers chez des patientes présentant une hémorragie du post-partum primaire. Tous les cas d'hémorragie du post-partum transférés ont été inclus et répartis en deux groupes selon le volume des pertes sanguines : < 2500 ml et ≥ 2500 ml. Les caractéristiques cliniques, les complications et les modalités thérapeutiques ont été comparées entre les groupes. Les patientes présentant une perte sanguine ≥ 2500 ml avaient une incidence significativement plus élevée de coagulation intravasculaire disséminée, de dysfonction d'organes, d'admission en unité de soins intensifs, ainsi qu'une durée d'hospitalisation prolongée. Les lésions du canal génital constituaient plus fréquemment la cause du saignement dans ce groupe (P < 0,05). Des interventions plus agressives avant le transfert, notamment le tamponnement utérin, les sutures de B-Lynch, la ligature vasculaire pelvienne et l'hystérectomie, ont été plus souvent nécessaires dans le groupe ≥ 2500 ml (P < 0,05), de même qu'une transfusion significativement plus importante de produits sanguins. L'augmentation des pertes sanguines post-partum était associée à une aggravation des issues maternelles et à une intensification des traitements. Ces résultats soulignent l'importance d'une prise en charge active précoce de l'hémorragie du post-partum et d'un transfert opportun une fois l'état de la patiente stabilisé afin d'améliorer le pronostic. *(Afr J Reprod Health 2026; 30 [5]: 64-73).*

Mots-clés: Hémorragie du post-partum; transfert hospitalier; caractéristiques cliniques; causes du saignement; dysfonction d'organes; traitement

Introduction

Postpartum hemorrhage (PPH) represents a prevalent and serious complication during childbirth and stands as the primary cause of maternal mortality.[1] Globally, PPH contributes to 8% of maternal deaths in developed regions and 20% in less developed regions[2]. Although between 2000 and 2020, there was a notable reduction of approximately 34% in the global maternal mortality rate (MMR, maternal deaths per 100,000 live births), but severe bleeding, predominantly postpartum bleeding, has continued to be the foremost cause of maternal mortality.[3] In 2019, obstetric hemorrhage constituted 16.9% of the leading causes of maternal mortality in China. Considering the proportion of prenatal and postpartum hemorrhage, PPH accounted for

approximately 11.9% of maternal mortality causes in 2019. As of January 2021, China's maternal and child health monitoring data have revealed a reduction in the maternal mortality rate from 53/100,000 in 2000 to 17.8/100,000 in 2019, with a remarkable 85.6% decrease in maternal mortality attributed to obstetric hemorrhage. Nevertheless, obstetric hemorrhage persists as the primary cause of maternal death in China[4].

Most maternal fatalities resulting from postpartum hemorrhage stem from delays in diagnosis and treatment, which are preventable and avoidable[5]. Discrepancies exist in the strategies for preventing, promptly diagnosing, and treating PPH between high-income and low/middle-income regions. Existing national guidelines advocate for the treatment of women with a high prenatal risk in tertiary hospitals equipped for such care[2,6-8]. However, postpartum hemorrhage often eludes prediction, as it can affect all women, particularly severe postpartum hemorrhage. Consequently, patients requiring blood transfusions in the event of postpartum hemorrhage often necessitate urgent transfer to comprehensive tertiary referral centers for further management.

Currently, there is a paucity of research on the impact of inter-hospital referrals for pregnant women. An assessment of the safety of patients experiencing severe hemorrhage necessitating more than 4 units of blood transfusion across varying levels of hospitals was conducted in South West Wales. The findings recommended that women at high risk of bleeding should predominantly receive treatment in tertiary institutions, alongside the proposal that all delivery hospitals should possess the capability for massive blood transfusions and the prompt initiation of treatment[9]. India accounts for approximately 15% of the global maternal mortality rate. A retrospective study unveiled that within one year, the rate of obstetric referrals in a secondary hospital in South India was 3%, with postpartum hemorrhage accounting for around 11% of cases[10]. Based on data from the 2014-2016 US National Emergency Medical Service (EMS) database, only 0.6% of inter-hospital referrals were related to maternal referrals[11]. Consequently, research on the implications of inter-hospital referrals for pregnant women remains scarce, leaving uncertainty surrounding the timing of referrals, the assessment of risks during referrals, and whether the timing of referrals correlates with adverse outcomes.

This retrospective study analysed cases of postpartum hemorrhage referrals over the decade in a comprehensive tertiary referral centre in Beijing, which has an annual delivery rate exceeding 6,000. The study aimed to address the following issues: To examine the clinical characteristics, causes of bleeding, and treatment strategies employed in postpartum hemorrhage (PPH) referral cases with varying levels of bleeding volume prior to referral; To assess the clinical features, subsequent treatment, and adverse outcomes in PPH cases at the time of transfer. Additionally, the timing and safety of these referrals were evaluated to offer valuable insights into postpartum hemorrhage referrals.

The focus of this study is to fill a gap in research on inter-hospital referrals for postpartum hemorrhage (PPH) in China. It explores the policies and practices of Beijing's three-tier referral network and proposes methods to enhance training for high-risk cases and early referrals, enabling solutions to be adapted to different primary medical units.The study conducts an in-depth analysis of how the severity of bleeding affects various outcomes—including disseminated intravascular coagulation (DIC), organ dysfunction, and admission to the intensive care unit (ICU)—which has not been sufficiently explored in previous referral studies.It provides evidence-based recommendations on the optimal timing for PPH referrals, emphasizing that referrals should occur after patient stabilization rather than immediately during crises. The findings challenge potential delays by showing that most referrals in the study were timely, with no significant differences in referral times between groups, offering practical guidance for improving maternal survival rates.

Methods

Design and data collection

This was a retrospective study of multi-center referrals. Peking University Third Hospital serves as a tertiary referral centre for critically ill pregnant women in Beijing. We collected data on postpartum

hemorrhage cases from primary maternity health care centers referred to the hospital from January 2012 to June 2023. Exclusion criteria encompassed cases with incomplete data or inconsistent conditions, resulting in the inclusion of 78 primary postpartum hemorrhage cases.

Description of study

Postpartum hemorrhage with blood loss exceeding 2,500 ml is classified as substantial or life-threatening, as it can readily lead to hypovolemia and shock[12]. The NATA consensus statement recommends that PPH cases with blood loss exceeding 2,500 ml should trigger a massive transfusion protocol[13]. Accordingly, this study stratified cases into two groups based on postpartum hemorrhage volume, namely the < 2500 ml group（35 people）and the ≥ 2500 ml group（43 people）. We compared general clinical characteristics, bleeding causes, clinical conditions at the time of transfer to our hospital, as well as treatment modalities before and after referral between these two groups.

Diagnosis of PPH and DIC

The diagnostic criteria for postpartum hemorrhage align with the 2017 ACOG Guidelines for Postpartum Hemorrhage. This entails fetal blood loss exceeding 1000 ml within 24 hours after delivery or the presence of unstable vital signs[7]. The diagnostic criteria for disseminated intravascular coagulation (DIC) refer to the 2023 Chinese expert consensus on clinical diagnosis and treatment of obstetric disseminated intravascular coagulation. The consensus is mainly based on the primary disease, clinical manifestations, laboratory tests, enacting the Chinese DIC scoring system, and the total score of more than 7 points can diagnose DIC[14].

Data collection

Clinical characteristics, including maternal age, gravidity, parity, gestational week, gestational hemoglobin (Hb), mode of delivery, and pregnancy complications such as hypertensive disorders of pregnancy (HDP), gestational diabetes mellitus (GDM), twin pregnancy, cicatricial uterus, and placenta previa were extracted from the medical records. Cicatricial uterus includes, but is not limited to, placenta accreta. Data on onset-to-referral time, the presence of disseminated intravascular coagulation (DIC), bleeding causes, clinical assessments upon transfer, organ damage, treatment methods before and after referral, intensive care unit (ICU) admissions, and length of stay were also collected. All the data is sourced from the Beijing Maternal and Child Health Project Phase III platform. This platform is a women and children's health management information system centered on maternal and child health records, and it shares clinical information with relevant institutions. From this platform, clinical data and referral information from various medical institutions can be collected. This study collected referral cases from 18 subordinate primary maternity health care centers. All the data were sourced from a unified platform, ensuring the reliability and accuracy.

Statistical analysis

All statistical analyses were conducted using SPSS Statistics 26.0 software. Initially, the Shapiro-Wilk test was utilised to assess the normal distribution of continuous variables. Subsequently, descriptive measurements for data were expressed as Mean ± SD or M (P25, P75) based on their distribution. Student's T-test or Mann-Whitney U-test was employed to compare independent samples, while paired samples were evaluated using the paired samples T-test or Wilcoxon signed-rank test. Count data were presented as frequency and percentage, with analysis between independent samples conducted using the Pearson Chi-square test or Fisher's exact test. The McNemar test was employed for chi-square testing between paired samples. Furthermore, Bonferroni correction was applied for pairwise comparisons of categorical variables among multiple groups. A significance level of $P < 0.05$ was considered statistically significant.

Ethics approval and consent to participate

This study received approval from the Medical Research Ethics Committee of Peking University Third Hospital (approval no.: 2021-561-02). Due to

the retrospective nature of the study, the requirement for written informed consent was waived.

Results

A total of 83 patients who were referred because of primary PPH were initially included in the study. Following the exclusion of 4 cases with incomplete data and 1 case involving splenic rupture, the final analysis included 78 patients (Figure 1). Data comparisons between the included and excluded patients are detailed in the appendix.

Clinical characteristics of pregnant women with different amounts of bleeding

In this study, 24 cases (68.6%) were primiparas, while 25 cases (32.1%) involved elderly pregnant women. Forty four cases (56.4%) underwent cesarean section for delivery. The most prevalent complication observed was hypertensive disorders of pregnancy (29.5%). Through the data sharing platform, we obtained the time when the patients were diagnosed with PPH. Then, we collected the admission time recorded in the cases when they were referred to our hospital. Based on this, we calculated the median duration from the diagnosis of PPH to referral was 9 hours. A statistically significant discrepancy in Disseminated Intravascular Coagulation (DIC) ($P = 0.000$) was noted among cases with varying levels of bleeding. Conversely, there were no statistically significant distinctions between the two groups when comparing general clinical characteristics such as maternal age, gravidity, parity, gestational week, and pregnancy-related complications (Table 1).

Analysis of the proportion of bleeding causes in different bleeding volumes before referral

Uterine atony emerged as the primary cause of postpartum hemorrhage before referral. Birth canal laceration constituted the second most common cause of severe postpartum hemorrhage, with only one case involving bleeding volume less than 2500ml, marking a statistically significant difference between the two groups ($P < 0.05$). Of the 11 cases attributed to birth canal laceration, 4 occurred in cesarean section deliveries (comprising 2 cases of uterine rupture, 1 case involving uterine incision down to the cervix, and 1 case of uterine artery rupture and bleeding). Additionally, among the 7 cases of vaginal delivery within this category, 4 were associated with forceps-assisted deliveries (Table 2).

Clinical characteristics of patients with different amounts of blood loss transferred to our hospital

Upon admission to our hospital, the platelet count in the ≥2500ml blood loss group was notably lower than that in the < 2500ml blood loss group, and the Activated Partial Thromboplastin Time (APTT) was higher in the former ($P < 0.05$). However, there were no significant disparities in arterial pH, lactic acid levels, base excess, hemoglobin, and fibrinogen. Concurrently, the proportion of ICU admissions, the length of stay in the ICU, and the overall hospital stay duration were higher in the ≥ 2500ml group compared to the < 2500 ml group, with statistical significance ($P < 0.05$). Among the referred cases, 28 individuals were diagnosed with DIC that had not been resolved upon arrival at our hospital. Nevertheless, no statistical differences were observed between the two groups. Among the referred cases, there was one maternal fatality involving a twin pregnancy complicated by acute fatty liver, necessitating hysterectomy, and resulting in liver and kidney failure, as well as cerebral edema before referral. Unfortunately, this patient succumbed 17 days after ICU admission (Table 3).

In this study, 53 cases (67.9%) exhibited organ dysfunction, with 29 cases (37.2%) manifesting multiple organ dysfunctions. The highest proportion of organ dysfunction was observed in cardiopulmonary function and renal function, with 24 cases (30.8%) and 19 cases (24.4%) respectively. Three cases experienced cardiac arrest and required cardiopulmonary resuscitation and total hysterectomy. Despite suffering from multiple organ failure, all three survived. The incidence of organ dysfunction in the ≥ 2500ml blood loss group was significantly higher than that in the < 2500ml blood loss group ($P < 0.05$) (Table 3).

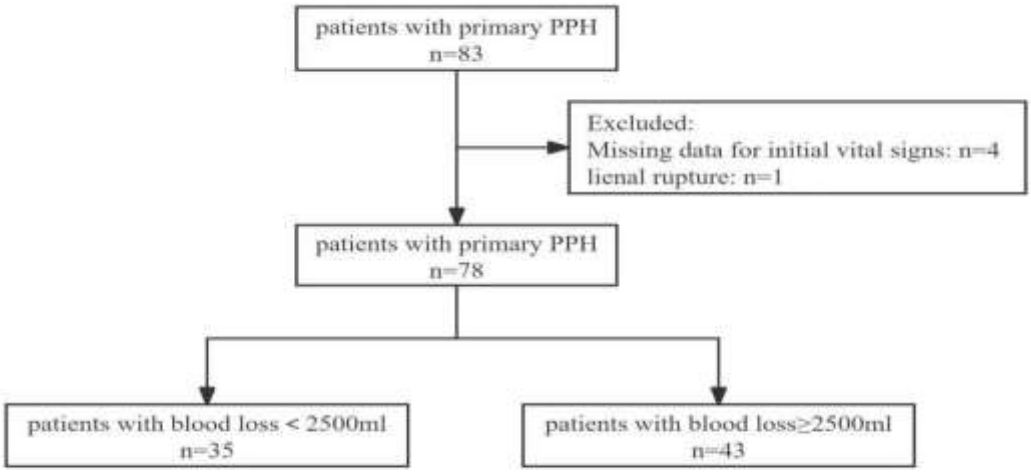

Figure 1. Flow diagram of study population.

Figure 1: Flow diagram of study population.

Table 1: General clinical characteristics of parturients with different PPH

Clinical Features	Total N=78	Bleeding Volume ＜2500ml N=35	Bleeding Volume ≥2500ml N=43	Test value	P value
Age (years)	32.62±4.857	32.31±4.523	32.86±5.153	-0.492[a]	0.624
≥35(n, %)	25(32.1)	10(28.6)	15(34.9)	0.353[c]	0.552
Gravidity	2(1,3)	2(1, 3)	2(1, 3)	1.395[b]	0.163
Parity				0.899[c]	0.343
Primiparity(n, %)	49(62.8)	24(68.6)	25(58.1)		
Pluriparity(n, %)	29(37.2)	11(31.4)	18(41.9)		
Gestational week	39(37.5, 40.1)	38.7(37.0, 39.6)	39.4(38.0, 40.6)	1.885[b]	0.059
Gestational Hb(g/dL)	113.46±11.059	113.94±10.803	113.07±11.375	0.345[a]	0.731
Hb<110 (n. %)	34 (43.6)	15 (42.9)	19 (44.2)		
Hb≥110 (n. %)	44 (56.4)	20 (57.1)	24 (55.8)		
Delivery mode (n. %)				1.587[c]	0.208
Vaginal delivery	34(43.6)	18(51.4)	16(37.2)		
Cesarean section	44(56.4)	17(48.6)	27(62.8)		
Complications (n. %)					
HDP	23 (29.5)	11(31.4)	12(27.9)	0.115[c]	0.734
GDM	17 (21.8)	7(20.0)	10(23.3)	0.120[c]	0.729
Twin pregnancy	5 (6.4)	1(2.9)	4(9.3)		0.372
Cicatricial uterus	10 (12.8)	4(11.4)	6(14.0)		1.000
Placenta previa	7(9.0)	3(8.6)	4(9.3)		1.000
Onset to referral time(hour)	9 (6,18)	8 (5,24)	10 (6,15)	0.695[b]	0.487
DIC (n, %)	50(64.1)	14 (40.0)	36 (83.7)	16.028[c]	0.000[*]

Note：[a] is the T value, [b] is the Z value, [c] is the χ^2value。[*] indicates a statistically significant difference.

Table 2: Analysis of the causes of different PPH before referral

Cause of bleeding	Total N=78	Bleeding Volume <2500mlN=35	Bleeding Volume ≥2500mlN=43	χ^2	P value
Uterine atony（n，%）	33（42.3%）	14（40.0）	19（44.2）	0.139	0.710
Placental factors（n，%）	18（23.1%）	11（31.4）	7（16.3）	2.495	0.114
Birth canal laceration（n，%）	11（14.1）	1（2.9）	10（23.3）		0.019*
Coagulation defects（n，%）	16（20.5）	9 (25.7)	7（16.3)	1.053	0.305
Placental abruption	5（6.4）	4(11.4)	1（2.3）		
HELLP syndrome	3（3.8）	2(5.7)	1（2.3）		
Amniotic fluid embolism	7（9.0）	3(8.6)	4（9.3）		
Acute fatty liver	1（1.3）	0（0.0)	1（2.3）		

Note：* indicates a statistically significant difference

Table 3: Clinical characteristics of different blood loss when transferred to our hospital

Clinical Features	Bleeding Volume <2500mlN=35	Bleeding Volume ≥2500ml N=43	Test value	P value
PH	7.404（7.340，7.430）	7.350（7.234，7.430）	1.036[b]	0.300
Lactic acid（mmol/L）	2.00（1.60，2.60）	2.80（1.50，4.50）	1.317[b]	0.188
Base excess（mmol/L）	-1.78±4.71	-2.25±5.20	-0.07[a]	0.944
Hemoglobin（g/L）	95.06±14.814	92.28±20.777	0.665[a]	0.508
Platelets (*10^9/L)	122.06±61.384	85.60±40.127	3.155 [a]	0.002*
Fibrinogen ((g/L)	3.28±1.13	2.93±1.05	1.395[a]	0.167
APTT（s）	29.5（25.6，33.2）	33.9（29.9，39.9）	3.567[b]	0.000*
Organ dysfunction（n,%）				
No organ dysfunction	18 (51.4)	7(16.3)	10.824[c]	0.001*
One organ dysfunction	6（17.1）	18（41.9）	6.268[c]	0.012*
Two organ dysfunction	11 (31.4)	18 (41.9)	0.043[c]	0.836
Still DIC after transfer（n,%）	13 (37.1)	15 (34.9)	-0.620[c]	0.536
Bleeding volume after transfer	155（0，1000）	50（0，1258）	12.554[c]	0.000*
ICU admission（n,%）	24（68.6）	42（97.7）	3.032 [b]	0.002*
Length of ICU stay（day）	1 (0, 4)	3 (2,8)	2.845 [b]	0.004*
Length of hospital stay（day）	7 (5,12)	10 (7,16)		1.000
Maternal death（n,%）	0 (0)	1 (2.3)		

Note：[a] is the T value，[b] is the Z value，[c] is the χ^2value。* indicates a statistically significant difference

Treatment of different amounts of blood loss before and after referral

Hysterectomy was performed in 18 cases within this study, with 12 cases undergoing the procedure before referral. Additionally, intrauterine balloon tamponade was utilized in seven cases, all of which were administered prior to referral. Notably, there was no significant difference in surgical and interventional therapy before and after referral in the < 2500ml blood loss group. Conversely, in the ≥ 2500ml blood loss group, the proportion of procedures such as intrauterine tamponade, uterine B-Lynch suture, pelvic vascular ligation, and hysterectomy performed before referral was significantly higher ($P < 0.05$).

Regarding blood transfusion treatment, the quantity of red blood cells, plasma, platelets, fibrinogen, and prothrombin complex transfused before referral was markedly higher than that administered after referral in the ≥ 2500ml blood loss group ($P < 0.05$). Conversely, in the < 2500ml blood loss group, fibrinogen was administered in greater quantities before referral compared to after referral ($P < 0.05$), with no disparities observed in the transfusion of other blood products before and after referral ($P > 0.05$) (Table

Table 4: Treatment before and after referral for different PPH

Treatment	Bleeding Volume <2500ml(n=35)		P value	Bleeding Volume≥2500ml (n=43)		P value
	Before referral	After referral		Before referral	After referral	
Surgery and Interventional Therapy (n, %)						
Uterine tamponade	4(11.4)	0（0）	0.125	11(25.6)	0（0）	0.001*
Uterine B-Lynch suture	2（5.7）	2（5.7）	1.000	7(16.3)	0（0）	0.016*
Pelvic vascular ligation	2（5.7）	2（5.7）	1.000	13（30.2）	3（7.0）	0.013*
Uterine artery embolization	0（0）	3（8.6）	0.250	1（2.3）	3（7.0）	0.625
Hysterectomy	0（0）	3 (8.6)	0.250	12(27.9)	3（7.0）	0.035*
Birth canal laceration suture	0（0）	4（11.4）	0.125	2（4.7）	3（7.0）	1.000
Blood transfusion	6（2, 8）	2（0, 6）	0.117	14（12, 20）	4（0, 12）	0.000*
Red blood cells (IU)	800(0,1100)	0(0,800)	0.239	1600(1200, 2000)	0（0, 1200）	0.015*
Plasma (ml)	0（0, 1）	0（0, 0）	0.677	1(0, 2)	0（0, 1）	0.041*
Platelets (IU)	4（0, 8）	0（0, 0）	0.000*	9 (4.5, 12)	0（0, 0）	0.000*
Fibrinogen (g)	0（0, 0）	0（0, 0）	0.891	0 (0, 600)	0（0, 0）	0.039*
Prothrombin complex (IU)	4(11.4)	0（0）	0.125	11(25.6)	0（0）	0.001*

Discussion

According to the 2021 data report on maternal and child information in Beijing, the maternal mortality rate has been reduced to 2.22/100,000[15]. In a concerted effort to prevent maternal fatalities resulting from postpartum hemorrhage, Beijing has instituted a streamlined referral system for postpartum hemorrhage treatment citywide. This has culminated in the establishment of a three-tier treatment network system, encompassing hospitals at the municipal, district, and local levels. In the event of severe hemorrhage during childbirth, hospitals are promptly required to initiate their emergency response plans, swiftly mobilizing the hospital-level rescue team for immediate intervention. Primary hospitals are encouraged to proactively refer patients to nearby critical maternal treatment centres via the established transportation network, thus ensuring timely follow-up care prior to the escalation of the condition. For cases deemed unsuitable for immediate referral, superior hospitals can dispatch medical professionals to the primary hospital to provide on-site guidance, with referral occurring once the patient's condition stabilities.

Our study identified an increase in the incidence of Disseminated Intravascular Coagulation (DIC) and the proportion of organ dysfunction in PPH patients with ≥ 2500 ml of blood loss. However, there was no disparity in the timing of referral between the two groups. Does this imply a delay in the referral process for these patients? We delved deeper into the distinctions in the causes of bleeding across varying blood loss levels and discovered that cases with bleeding volumes below 2,500 ml exhibited a higher prevalence of placental factors and coagulation defects. Notably, 12 of these cases were attributed to placental implantation, constituting 66.7% of placental-related factors. Coagulation defects primarily stemmed from atypical delayed amniotic fluid embolism, HELLP syndrome, placental abruption, and acute fatty liver. Following active treatment at lower-level hospitals, these patients opted for more proactive referrals, considering the potential for subsequent bleeding and organ dysfunction. In contrast, cases involving bleeding exceeding 2500 ml were primarily caused by uterine atony and birth canal laceration, often accompanied by unstable vital signs during the rescue process. These patients lacked the conditions necessary for immediate referral and required initial treatment at the primary hospital, resulting in relatively longer referral times. Nonetheless, for the majority of these cases, our hospital's medical personnel were on hand to participate in the rescue

efforts, ensuring that there was no delay in the referral process due to manpower shortages. Notably, 64.1% of the cases in this study presented with DIC, with discrepancies observed between the two groups. At the time of referral, 35.9% of cases still exhibited uncorrected DIC; however, no statistical differences were identified in these cases. This suggests that the majority of DIC cases in the ≥ 2500 ml blood loss group had been effectively managed. These patients experienced substantial bleeding and critical conditions but were transferred under stable conditions. Consequently, when determining the appropriate timing for referral, priority should be accorded to the patient's condition and ongoing treatment, with referral occurring once the condition has stabilised. Our findings indicate that there was no delay in the timing of referrals in the referred cases.

In this study, 26 cases (33.3%) underwent interventional or surgical procedures following referral. We conducted further investigations to assess the variances in treatment modalities before and after referral and their impact on the referral process. Our findings revealed that a higher number of active interventions, such as uterine tamponade, uterine B-Lynch suture, pelvic vascular ligation, and hysterectomy, were performed in the group with blood loss ≥ 2500 ml before referral. Although there were no disparities in surgical treatment before and after referral in the blood loss < 2500 ml group, three cases underwent uterine artery embolization, and three cases required hysterectomy after referral. This suggests that these patients had unstable conditions with active bleeding still occurring. Furthermore, we analyzed the differences in treatment before and after referral. Intrauterine tamponade is recognized as a safe and effective first-line treatment for postpartum hemorrhage[16]. However, as the volume of bleeding increases, the risk of severe complications such as Disseminated Intravascular Coagulation (DIC) and organ dysfunction escalates. Consequently, relying solely on intrauterine tamponade may prove insufficient for successful rescue. Notably, no cases of intrauterine tamponade were repeated after referral to our hospital. Instead, all cases necessitated interventional and surgical treatments. Hysterectomy, being the ultimate resort when other interventions fail, plays a crucial role in the management of postpartum hemorrhage. Both the Royal College of Obstetricians and Gynaecologists (RCOG) and the Royal Australian and New Zealand College of Obstetricians and Gynaecologists (RANZCOG) underscore the importance of considering perinatal hysterectomy "sooner rather than later" when dealing with life-threatening bleeding[17,18]. Approximately 0.1% of births in the United States result in hysterectomy[19]. In our study, six patients underwent hysterectomy following referral, indicating that they remained in a relatively critical condition post-referral. For these patients, more prompt consideration of hysterectomy at primary hospitals may avert the need for extensive blood transfusions and mitigate organ dysfunction. Transcatheter arterial embolization (TAE), first employed to manage uncontrollable postpartum hemorrhage in 1979[20], has since gained acceptance as an effective and safe alternative to hysterectomy. In our study, seven cases underwent uterine artery embolization, with only one case receiving this intervention before referral, while the remaining six cases underwent the procedure after referral. Given that these differences are attributed to the limited availability of interventional capabilities in some primary hospitals, it is advisable to refer these patients earlier to ensure timely interventional treatment and reduce unnecessary surgical interventions.

We observed that the majority of referrals occurred under stable conditions, although roughly one-third of cases may still harbour instability. Further investigations into risk assessments for these cases during the referral process should be conducted, taking into account vital signs and clinical examinations. Our findings also suggest that certain measures could potentially reduce the incidence of PPH referrals. For instance, in cases involving high-risk operations with PPH risks, such as placental implantation, early referral during pregnancy could potentially avert severe postpartum hemorrhage. Moreover, birth canal laceration-related bleeding often stems from surgical procedures. Therefore, enhancing training in cesarean section and midwifery techniques at lower-level hospitals could help reduce the occurrence of serious complications during vaginal delivery, ultimately lowering the frequency of emergency referrals due to severe PPH.

Strengths

There are few referral studies on postpartum hemorrhage in China. This research analyzed the clinical characteristics of different bleeding volumes as well as the treatment, solved the practical clinical problems of postpartum hemorrhage referral. This study also provides evidence-based guidance on referral timing, emphasizing stabilization before transfer—a novel contribution to PPH management protocols. It also highlights differences in pre-referral interventions (such as uterine tamponade and hysterectomy) and transfusion needs, offering actionable insights for managing severe PPH. By analyzing real-world referral patterns within the Chinese medical context, this research lays the groundwork for multicenter studies and the optimization of PPH management strategies.

Limitations

This research is based on data from a single urban centre with a relatively small sample size, which limits its applicability to more developed regions in China. Another limitation is that this study did not gather information on intervention measures employed by clinicians during the transport process, such as mechanical ventilation or the use of vasoactive drugs. Additionally, the influence of vital signs and clinical examinations on the risk of referral was not explored, which should be integrated in future studies. Given these limitations, future research should encompass multicenter, larger sample size studies to better inform the management of critical cases involving postpartum hemorrhage.Due to the center being a high-resource tertiary facility, the findings may not be fully applicable to primary-care settings.

Implications of the results for policy and practice

This study found that early stabilization therapy is of great significance, suggesting the need to establish standardized referral protocols for postpartum hemorrhage. Beijing's three-tier network could be strengthened by implementing real-time vital sign monitoring during patient transfers. The research supports proactive referral of high-risk cases (such as placental disorders) and training primary hospitals in techniques like uterine tamponade and hysterectomy to enable earlier intervention capabilities. Future multicenter studies with larger sample sizes are necessary to validate these findings and optimize maternal survival strategies

Conclusion

This study ascertained that as postpartum blood loss increases, the need for blood transfusion, the incidence of surgical and interventional therapy, including hysterectomy, rises, alongside an increased prevalence of DIC and organ dysfunction. The duration of ICU and hospital stays also significantly lengthens. Therefore, early identification of high-risk factors for postpartum hemorrhage, prompt intervention, active treatment, timely initiation of referrals prior to disease progression, and intrauterine referrals when necessary are essential to ensure maternal safety and prevent adverse outcomes.

Conflict of interests

The authors declare that they have no conflict of interest.

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Authors' contributions

Yan Zhang: project development, manuscript writing. Mingfang Yang: data collection, data analysis and manuscript writing. Yuanyuan Wang, Xiaoyue Guo and Lei Chen: data collection, data analysis. Hongqing Jiang: data collection. Shaohua Yin: data analysis. All authors read and approved the final manuscript.

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