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Original Article

A risk factor analysis and prediction model of placental abruption

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Abstract: Objective: To investigate the risk factors for the incidence of placental abruption and establish a model for placental abruption prediction. Methods: We retrospectively analyzed the clinical data of 303 placental abruption patients who were hospitalized and delivered in the Department of Maternity of Fujian Maternal and Child Health Hospital from January 2017 to December 2017. Univariate and multivariate logistic regression analyses were used to analyze the risk factors for placental abruption. The multivariate logistic regression OR method was used to preliminarily establish the "placental abruption prediction model". Results: (1) The multivariate logistic regression analysis showed that advanced maternal age, multigravida, irregular prenatal care, hypertensive disorder complicating pregnancy (HDCP), premature rupture of membranes (PROM), fetal growth restriction (FGR) and anemia are independent risk factors for the incidence of placental abruption. (2) The "placental abruption prediction model" predicted that the AUC of the placental abruption under the ROC curve is 0.777. When the total score reached the critical value of 5 points, the prediction of placental abruption sensitivity was 67.3%, and the specificity was 74.3%. Conclusions: Placental abruption is closely related to advanced maternal age, multigravida, irregular prenatal care, HDCP, PROM, FGR and anemia. The "placental abruption prediction model" has a certain predictive value for the incidence of placental abruption.

Keywords: Placental abruption, predictive model, risk factors, maternal and child outcomes

Introduction

Placental abruption is the premature separation of part of the placenta after 20 weeks of gestation or at normal parturition before the delivery of the fetus [1]. Placental abruption can cause maternal hemorrhagic shock, disseminated intravascular coagulation, postpartum hemorrhage, and maternal death, which can increase adverse neonatal outcomes. The cause of placental abruption may be related to decreased trophoblastic invasion, poor placental function and hypoperfusion, chronic hypertension, decreased intrauterine pressure, intrauterine hypoxia, and external force injuries, which are associated with placental decidual hemorrhage [2]. China clinically uses the placental abruption classification criteria for the assessment and judgment of the condition. The grading standards from grade 0-III are mainly based on the degree of clinical manifestations and laboratory test results that can be measured in the mother and fetus [3]. The clinical manifestations and signs of grade II and III placental abruptions are more typical, and the diagnosis is generally no more difficult, but grade 0 and I placental abruption symptoms and ultrasound images are not typical and can easily lead to missed diagnoses or misdiagnoses [4]. The current need for confirmed placental abruptions is based on the pathological diagnosis seen during or at the time of delivery or delayed delivery. The prognosis of placental abruption is closely related to its early diagnosis and timely management. Therefore, it is particularly important to look for early risk factors for placental abruption, prediction or early detection, and to provide timely treatment of placental abruption.

Methods

Patient information

The subjects of the study were all selected from among the pregnant women at the Fujian Provincial Maternal and Child Health Hospital affiliated to Fujian Medical University (Fujian Severe Critical Referral and Newborn Care Center) from January 1, 2017, to December 31, 2017. The information of 16,397 people was retrieved from the patients' electronic medical records and examination results from the hospital information center. Inclusion criteria: cases of placental abruption that were clinically or pathologically confirmed, cases that met the criteria for the diagnosis of placental abruption, and the provision of informed consent. Exclusion criteria: 1) Systemic factors: coagulopathy, vascular disease, autoimmune diseases, etc.; 2) Obstetric hemorrhagic disease: placenta previa, placenta accreta, threatened uterine rupture, rupture of anterior vasculature, placental tumor, etc.; 3) Non-obstetric-induced bleeding: vaginal disease, cervical lesions, submucosal uterine fibroids, etc.; 4) Incomplete records of available case data. A total of 303 patients with placental abruption were included in this study as a case group (excluding 7 patients with placental abruption who met the exclusion criteria: pre-placental status in 3 cases, presumed placenta in 1 case, and missing data in 3 cases). Using a 1:1 retrospective case-control study design, another 303 randomly selected patients who did not have placental abruption during the same period were used as controls.

Research design

The maternal clinical data included the following: general maternal status (age, parity, number of caesarean sections, family history), prenatal examination (ART, number of prenatal care visits, first gestational weeks, and prenatal related laboratory tests), maternal complications (chronic hypertension, diabetes, hyperthyroidism, hypothyroidism, anemia, uterine fibroids, uterine malformations, ovarian masses, twin pregnancy, HDCP, gestational diabetes, polyhydramnios, oligohydramnios, FGR, PROM, intrauterine infections, ruptured uterus, peripartum hysterectomy, acute renal failure, PPH, etc.), childbirth (clinical manifestations of placental abruption, clinical grade, gestational weeks and methods, labor or duration of surgery, prevention of postpartum hemorrhage, medications, placental and fetal membrane residuals, etc.), postpartum-related conditions (range of placental margin pressure area, uterine bleeding, postpartum hemorrhage, blood transfusion, admission to ICU, pathological features), and perinatal outcomes.

The criteria for the diagnosis of placental abruption (cf. Williams Obstetrics (24th edition)) [1] included the placental abruption grading standard (refer to the clinical diagnosis and treatment specification of placental abruption (first edition) [unified standard]) [5].

The analysis used the dependent variable for patients with placental abruption, followed by a univariate analysis to screen for significant factors affecting placental abruption. A univariate analysis was used to screen the factors that had a significant effect on placental abruption, and a multivariate logistic regression analysis was carried out to obtain the independent influencing factors and the OR value of each factor. According to the rounding of the OR values, a prediction model of placental abruption was established. Then, the total score was calculated for each patient based on the predictive model, which was the sum of the scores for each category. Using this score, the receiver operating characteristic (ROC) curve was drawn, the best demarcation value was designated, and the sensitivity and specificity were calculated to evaluate the validity of the prediction model.

Statistical method

All data were processed using the SPSS 18.0 statistical software package; normal distribution measurement data were expressed as the mean ± standard deviation ($\bar{x} \pm s$); the measurement data were compared using a group t test or a t'test, and the count data were compared using a chi-square test or a corrected chi-square test. Univariate and multivariate logistic regression analyses were used to analyze the risk factors for placental abruption. The AUC of ROC curve evaluates the prediction efficacy of the "placental abruption prediction model". The Youden Index determines the optimal predictive value of the "placental abruption

Table 1. Demographic and obstetric characteristics of the study participants

Maternal characteristics	Placental abruption n (%)	No placental abruption n (%)	*P* value
Maternal age (years)			
<35	231 (76.2)	258 (85.1)	0.005
≥35	72 (23.8)	45 (14.9)	
Parity (number)			
0	135 (44.6)	171 (56.4)	0.003
≥1	168 (55.4)	132 (43.6)	
Abortions (number)			
0	289 (95.4)	291 (96)	0.688
≥1	14 (4.6)	(4 (4)	
Hospitalization time (days)			
<5	214 (70.6)	236 (77.9)	0.041
≥5	89 (29.4)	67 (22.1)	
Medical expense (thousand RMB)			
<8	127 (41.9)	178 (58.7)	0.000
≥8	176 (58.1)	125 (48.3)	
Delivery method			0.001
Vaginal delivery	173 (57.1)	214 (70.6)	
Caesarean section	130 (42.9)	89 (29.4)	
Weeks gestation at childbirth[a]	34.86±4.71	38.93±1.68	0.00
Umbilical cord length (cm)[a]	51.02±11.51	58.54±12.57	0.00
Neonatal body mass (g)[a]	2404.72±897.07	3214.80±441.00	0.00

[a]Mean and standard deviation.

prediction model". *P*<0.05 was considered statistically significant.

Results

Demographic characteristics

From January 1, 2017 to December 31, 2017, the total number of hospitalizations in our hospital was 16,397, including 6,132 (37.4%) for caesarean sections and 10,265 (62.6%) for vaginal delivery. Three hundred and ten patients had a placental abruption, and the incidence was 1.89%. In the case group (excluding 7 patients with placental abruption who met the exclusion criteria), 125 cases (41.25%) had stage II placental abruptions, 7 cases (2.31%) had stage III placental abruptions, and 97 cases (32.01%) had grade 0 placental abruptions, while grade I placental abruptions occurred in 74 cases (24.42%). There were 160 cases (52.81%) of placental abruption in the pre-term, and the incidence rate was higher than the rate of the 143 cases (47.19%) of full-term placental abruption.

Compared to the control group, the case group had greater maternal age, parity, hospitalization time, and medical expense. The pregnancy duration, length of the umbilical cord, and body mass of the neonates in the case group were all shorter or lower than those in the control group. The difference was statistically significant (P<0.05), but the difference in the number of abortions between the two groups was not statistically significant (P> 0.05). The caesarean section rate was higher in the case group than it was in the control group (P<0.05) (See **Table 1**). After comparing the pregnancy outcomes of the two groups, the incidences of blood transfusions, ICU admissions, and PPH were higher in the case group, and the difference was statistically significant (P<0.05). There was no significant difference in uterine arterial ligation, secondary exploratory laparotomy, or hemorrhagic shock (P>0.05). In the comparison of neonatal prognosis, neonatal hypoproteinemia, abortion, premature infants, fetal distress, neonatal asphyxia, hyaline membrane disease, neonatal pneumonia, respiratory failure, SGA, anemia, hypoxic ischemic myocardial damage, coagulation dysfunction, NICU admission, and maternal blood swallowing syndrome were statistically more prevalent in the case group (P<0.05) (**Table 2**).

Table 2. Comparison of maternal and neonatal outcomes in the two groups

	Placental abruption n (%)	No placental abruption n (%)	*P* value
PPH	25 (8.3)	7 (2.3)	0.001
Blood transfusion	15 (5.00)	0 (0.00)	0.00
Check in to ICU	80 (26.40)	5 (1.70)	0.00
Uterine artery ligation	10 (3.30)	11 (3.60)	0.824
Secondary exploratory laparotomy	2 (0.70)	0 (0.00)	0.25
Hemorrhagic shock	2 (0.70)	0 (0.00)	0.25
Abortion	28 (10.10)	0 (0.00)	0.00
Premature birth	132 (47.70)	16 (5.40)	0.00
Fetal distress	83 (30.00)	9 (3.00)	0.00
Neonatal asphyxia	59 (21.30)	2 (0.70)	0.00
Respiratory failure	32 (11.60)	2 (0.70)	0.00
Neonatal pneumonia	80 (28.90)	6 (2.00)	0.00
Pulmonary hyaline membrane disease	23 (8.30)	2 (0.70)	0.00
Hypoproteinemia	43 (15.50)	2 (0.70)	0.00
SGA	101 (36.50)	12 (4.00)	0.00
Anemia in neonates	16 (5.80)	2 (0.70)	0.001
Hypoxic myocardial damage	59 (21.30)	4 (1.30)	0.00
Coagulation abnormalities	16 (5.80)	2 (0.70)	0.001
Check in to NICU	94 (33.90)	10 (3.30)	0.00
Maternal blood swallow syndrome	13 (4.70)	0 (0.00)	0.00

Note: In the case group, 21 cases of twin pregnancies were excluded, and 6 cases of labor due to fetal congenital abnormalities were induced by Lifano (including 1 case of a twin fetal pregnancy with fetal congenital dysplasia). The control group excluded 4 twin pregnancies.

The univariate analysis showed that for senior maternal age, multiparity, irregular birth, uterine malformation, ART, twin pregnancy, HDCP, FGR, anemia, PROM, short umbilical cord, the differences were statistically significant (P<0.05) (**Table 3**).

The 12 variables with statistical significance in the univariate analysis were analyzed using a multivariate logistic regression analysis. The results showed that the independent risk factors for placental abruption were advanced maternal age, multigravida, irregular prenatal care, HDCP, PROM, FGR, and anemia (*P*<0.05). In order to facilitate the calculation of the scores, the variables were combined with the normal range of physiological indicators in the international pregnancy, and the three consecutive variables of the patient's age, parity, and number of prenatal examinations were divided into the following table and classified as HDCP and anemia. The variables were transformed into rank order variables, and a further multivariate logistic regression analysis was performed. The forward Wald method was selected to obtain the corresponding OR values of each variable (see **Table 4**).

Preliminary establishment of "placental abruption prediction model"

The above seven independent risk factors were selected as the "placental abruption prediction model" score items, and the OR values were rounded off to an integer value. The corresponding multiples were accumulated, and the independent risk factors of each variable assignment table lead to the establishment of the "placental abruption prediction model" (See **Table 5**).

Statistically accumulated patients' variable scores were obtained from the respective total scores of the two groups of patients, and the corresponding ROC curve was drawn using the Youden index to determine the critical score for predicting placental abruption; when the total score reached 5 points (the critical point), the prediction of placental abruption sensitivity was 67.3%, and the specificity was 74.3%. The

Table 3. Univariate analysis of factors related to placental abruption

Variable	Groups	Placental abruption n (%)	No placental abruption n (%)	*P*	OR	95% CI
Maternal age	<35	231 (76.2)	258 (85.1)	0.005	1.787	1.183-2.7
	≥35	72 (23.8)	45 (14.9)			
Production times	0	135 (44.6)	171 (56.4)	0.003	1.612	1.17-2.222
	≥1	168 (55.4)	132 (43.6)			
Regular prenatal care	No	133 (43.9)	59 (19.5)	0	3.235	2.249-4.655
	Yes	170 (56.1)	244 (80.5)			
Uterine malformation	No	290 (95.7)	299 (98.7)	0.049	3.351	1.080-10.396
	Yes	13 (4.3)	4 (1.3)			
ART	No	275 (90.8)	288 (95.0)	0.04	1.955	1.022-3.739
	Yes	28 (9.2)	15 (5.0)			
Twin pregnancy	No	282 (93.1)	299 (98.7)	0.001	5.566	1.887-16.417
	Yes	21 (6.9)	4 (1.3)			
HDCP	No	257 (84.8)	287 (94.7)	0	3.211	1.774-5.811
	Yes	46 (15.2)	16 (5.3)			
FGR	No	204 (67.3)	277 (91.4)	0	5.17	3.237-8.258
	Yes	99 (32.7)	26 (8.6)			
Anemia	No	254 (83.8)	274 (90.4)	0.015	1.823	1.117-2.975
	Yes	49 (16.2)	29 (9.6)			
PROM	No	238 (78.5)	266 (87.8)	0.002	1.963	1.265-3.048
	Yes	65 (21.5)	37 (12.2)			
Umbilical cord length (cm)	<30	9 (3.0)	2 (0.7)	0.033	4.607	0.987-21.503
	≥30	294 (97.0)	301 (99.3)			
Placental thickness (cm)	0-5	291 (96.0)	303 (100)	0	1.041	1.018-1.065
	>5	12 (4.0)	0 (0)			

Note: Regular prenatal care means that the number of prenatal care is ≥9 times.

area under the curve (AUC) was 0.777 (95% CI 0.739-0.814).

Discussion

Domestic and international studies have reported that the incidence of placental abruption in singleton pregnancies is approximately 0.38%-1%. The incidence of placental abruption in twin pregnancy women is 1%-2%. The perinatal mortality and fetal congenital anomaly rates are approximately 4.4%-67.3%. More than 50% of perinatal fetal deaths and premature births are caused by placental abruption. This study showed that the incidence of placental abruption (1.89%) was higher than the incidence reported in the literature. The reasons for this finding may be related to differences in the study population and the study inclusion criteria. This study included patients who were not regularly evaluated in our hospital. Our hospital is a provincial-level, three-agency hospital. It is a maternal emergency and critical referral center and a neonatal care center. Critically ill patients are more concentrated, so the incidence rate of complications is higher.

Placental abruption risk factors

The results of this study showed that general information on maternal age, older mothers, multigravida, and irregular prenatal care were all independent risk factors for the incidence of placental abruption, and relevant research at home and abroad has confirmed the results. With the release of the two-child policy in China, the proportion of older pregnant women has increased significantly, and the management of maternal age has become an urgent problem in obstetrics. In Liu Xiaoli et al. [6], a large sample of epidemiological survey data on 110,450 maternal cases in 14 provinces, municipalities, and autonomous regions in China showed that the risk of placental abruption increased with age in the age group over 30 years. In the age group ≥40 years, the risk of placental abrupti-

Table 4. Multivariate logistic regression analysis of risk factors of placental abruption

Variable	B	SE	Wald	P	OR	95% CI
FGR	1.481	0.264	31.498	0.000	4.397	2.622-7.376
Advanced maternal age	-		5.444	0.066	-	-
≥35 years old	0.564	0.259	4.743	0.029	1.758	1.058-2.920
≥40 years old	0.648	0.597	1.181	0.277	1.912	0.594-6.158
Irregular prenatal care (<9 times)	1.054	0.206	26.095	0.000	2.869	1.915-4.299
Anemia	-		12.322	0.006	-	-
Mild anemia	0.881	0.341	6.667	0.010	2.412	1.236-4.706
Moderate anemia	1.176	0.506	5.409	0.020	3.241	1.203-8.732
Severe anemia	1.505	1.335	1.270	0.260	4.502	0.329-61.604
Parity	-		9.519	0.023	-	-
1	0.572	0.204	7.903	0.005	1.773	1.189-2.642
2	0.733	0.482	2.311	0.128	2.081	0.809-5.351
3	0.989	0.860	1.322	0.250	2.688	0.498-14.504
HDCP	-	-	15.587	0.004	-	-
Hypertension during pregnancy	0.560	0.491	1.301	0.254	1.751	0.669-4.582
Pregnancy with chronic hypertension	1.363	1.227	1.232	0.267	3.907	0.352-43.314
Preeclampsia	1.755	0.887	3.916	0.048	5.786	1.017-32.918
Severe preeclampsia	2.140	0.678	9.947	0.002	8.494	2.248-32.108
PROM	0.539	0.263	4.222	0.040	1.715	1.025-2.869

Table 5. Placental abruption prediction model

Variable	Rating (points)
HDCP	
Hypertension during pregnancy	2
Chronic hypertension combined with pregnancy	4
Preeclampsia	6
Severe preeclampsia	8
FGR	3
Old age (≥35 years)	2
Irregular prenatal care	3
Parity	
1 or 2	2
3	3
Anemia	
Mild anemia	2
Moderate anemia	3
Severe anemia	5
PROM	2

on is higher. This study showed that the risk of placental abruption was significantly increased in older patients (childbirth age of 35 years or older) compared to non-elderly patients. The analysis of the causes may be related to an increased risk of GDM, placenta previa, caesarean delivery, and ART in elderly patients [7]. Tikkaen et al. [8] retrospectively analyzed the clinical data of 6231 cases of placental abruption in pregnant women from 1980 to 2005 in Finland and found that being parturient was an independent risk factor for placental abruption. The risk of placental abruption was increased when the number of deliveries was more than 3, and the risk of placental abruption was the highest when it was more than 8. This study showed that in patients with placental abruption, the risk of placental abruption was higher than that of primipara, and the OR ratio of delivery times ≥3 times was higher than that of less than 3 times. Therefore, pregnant women, especially those who have delivered more than 3 times, should be strictly managed to be aware of placental abruption. Xie Xing et al. [9] considered that the number of regular prenatal check-ups during pregnancy is 9-11, and the amount of monitoring should be appropriately increased in patients with high-risk pregnancies. A cross-sectional study from Brazil [10] showed that the incidence rates of placental abruption, anemia, and HDCP were higher in patients who had irregular examinations than in those who had regular check-ups. This study has also come to similar conclusions: the irregular examination of patients

cannot provide relevant information during pregnancy, increasing the difficulty for medical staff giving perinatal health care and increasing adverse pregnancy outcomes. The necessity of regular prenatal examinations should be vigorously promoted.

This study shows that pregnancy complications are closely related to placental abruption, for which HDCP, FGR, PROM, and anemia are independent risk factors. A previous study [11] showed that placental abruption, FGR, and HDCP may have similar pathological mechanisms of placental origin and are manifested as ischemic placental diseases (IPD), i.e., the decreased invasive ability of trophoblasts, vascular lesions, and placental insufficiency. Chronic hypoxia releases cytokines and causes dysfunction of the body. Another previous study found that [12] the incidence of FGR increased in patients with HDCP, and some patients with concurrent FGR developed preeclampsia with increasing gestational age. Chun et al. [13] studied the data for 112,386 patients in 14 different grade hospitals in China and found that the risk of placental abruption in HDCP patients was significantly higher than the risk in healthy patients, which is consistent with the results of this study. Therefore, patients with HDCP should be closely monitored and treated in a timely manner to control the progression of the disease, thereby reducing complications. However, the mechanism of PROM complicated by placental abruption may be a reduced continuous outflow of amniotic fluid and a reduced volume of the uterine cavity, resulting in uneven pressure on both sides of the placenta; prolonged bed rest increases the tendency for thrombosis, leading to decidual coagulation dysfunction and increasing the risk for acute chorioamnionitis, which results in the separation of the decidua from the uterine wall. This previous study found [14] that 60% of patients with placental abruption had decidual vascular lesions, and 40% of those with placental abruption had histological changes in the chorioamnionitis. Current studies have suggested that [15] PROM and placental abruption may have similar 24-hour circadian rhythms, which are related to the maternal and fetal hypothalamic-pituitary-adrenal axes regulating the diurnal release of cortisol. The American Congress of Obstetricians [16] cautioned that placental abruption should be protected from PPROM regardless of the circumstances. This study also showed that the OR value of moderate anemia and placental abruption was above 3.0, and the OR value increased with the severity of anemia. The study by Hasegawa et al. [17] showed that maternal anemia combined with FGR during pregnancy increased the risk of abruption. In the present study, the scores of both pregnancy-associated anemia and FGR combined equaled 5 points, which is the best critical value for predicting placental abruption. Therefore, during pregnancy, anemia should be detected as soon as possible and promptly corrected. Patients with moderate to severe anemia should consider an infusion of suspended red blood cells [18] in order to reduce the incidence of placental abruption.

In addition, this study also found that uterine malformation, ART, twin pregnancy, umbilical cord length, placental thickness, etc., while not entered into the multiple regression model, were not independent risk factors, but a univariate analysis showed that they were significantly associated with placental abruption. Patients with the above factors should be followed closely to prevent placental abruption.

Preliminary establishment of "placental abruption prediction model"

Clinically, the risk assessment method for placental abruption is subjective. The risk of placental abruption cannot be assessed simply by superimposing the number of risk factors, especially when the patient has multiple risk factors at the same time. At this time, the trade-offs and overlap in the risk of placental abruption brought about by different risk factors depend, to a great extent, on the experience of clinicians, and there is often considerable disagreement among physicians. Individual analysis leads to several risk factors that can play a role in clinical applications, but it is still far from meeting clinical needs. Clinicians need a tool that can integrate multiple risk factors. As a quantification tool for clinical experience, the predictive model can provide considerable help for the clinician's initial screening without increasing medical expenses or requiring invasive examinations and can assist the clinician in the distribution of the patient's various risk factors. Information is integrated into an intuitive score to provide a reference for risk assessment of placental abruption.

In the design of the "placental abruption prediction model", a single factor analysis of placental abruption risk factors and a multivariate logistic regression analysis were used to determine the independent risk factors of placental abruption. The study eventually concluded that the prediction model contains 7 variables. On the basis of the range of normal values of physiological indicators in the international period of pregnancy, the variables were again graded, and the corresponding OR values were calculated. The OR values were taken as integers, and the corresponding values were summed to obtain the independent risk factors for each variable, thus establishing a prediction model. Multiple scores were gradually accumulated to get the total score for each pregnant woman. In this study, the "placental abruption prediction model" was used to calculate the total score of each mother, depicted as an ROC curve. The AUC was used to evaluate the effectiveness of the prediction model, and the results showed that the model predicted that the AUC of placental abruption was 0.777. When the total score reached 4 points, the prediction of placental abruption had a sensitivity of 78.5% and a specificity of 61.1%. The Youden index was 0.396. When the total score was 5 points, the prediction of placental abruption had a sensitivity of 67.3% and a specificity of 74.3%. The Youden index was 0.416. Thus, the latter cut-off had a larger index. Therefore, this study selected a total score of 5 points to predict the best cut-off value of placental abruption. When the total score reaches or exceeds 5 points, the risk of placental abruption increases. These groups should be included in focused guardianship.

Conclusion

Placental abruption is closely related to older age, multigravida, irregular prenatal care, HDCP, PROM, FGR, and anemia. In addition, the maternal and neonatal prognosis of placental abruption is poor, and the risk of PPH, blood transfusion, and ICU admission is increased. The cost of treatment is increased, and the length of hospital stay is prolonged. The neonatal risks of miscarriage, SGA, prematurity, neonatal asphyxia, and NICU admission are increased. The placental abruption prediction model, preliminarily formulated in this study through retrospective research, is a simple and practical method to identify patients at a high risk of placental abruption and has a certain predictive value regarding the occurrence of placental abruption. However, it is hoped that the model is universal. There is a need to use a wide range of sources of data because relying solely on one hospital is not sufficient. The results still need to be verified and improved with a larger sample of prospective multi-center clinical studies.

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Disclosure of conflict of interest

None.

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