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Short Communication

The Early Diagnosis and Treatment Strategy of Maternal near Miss

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Abstract

The WHO criteria for maternal near miss (MNM), defined as "a woman who nearly died but survived a complication that occurred during pregnancy, childbirth or within 42 days of termination of pregnancy". This review mainly analyses the amniotic fluid embolism (AFE), acute fatty liver of pregnancy (AFLP), HELLP syndrome and severe preeclampsia which may lead most cases of MNM. Finally, summarize the factors and managements associated with maternal near-miss morbidity.

INTRODUCTION

Maternal near miss refers to someone who survived a severe complication in pregnancy, childbirth, or the postpartum period. With the developing of our society, more and more people are concerned about the maternal near-miss morbidity and mortality. They also pay attention to the scientific and effective treatment measures to decrease the mortality of MNM-most happened in cases of amniotic fluid embolism (AFE), acute fatty liver of pregnancy (AFLP), HELLP syndrome and severe preeclampsia. This review will focus on the factors, the early clinical diagnosis and the management measures of MNM.

Kowloon Hospital is a private hospital, located in a new industrial park in Suzhou (SIP), Jiangsu Province, China. The SIP is one of the biggest industrial parks in China, and comprises 3 towns with an estimated population of 723 000 inhabitants, and a new industrial district. We conducted a retrospective study in which cases of maternal near miss were identified among women who were admitted to Kowloon Hospital between January 1, 2008 and December 31, 2012.

Over the 5-year period of the study, there were 18104 live births at Kowloon Hospital and 208 cases of potentially life-threatening conditions (PLTC). Because PLTC may progress to near miss or death, the process started with scrutiny of PLTC is important. Such specified conditions may be brought to the forefront—for example, severe pre-eclampsia; placental abruption; and hemolysis, elevated liver enzymes, and low platelets (HELLP) syndrome and some non-specified conditions such as seizures or shock. Urgent management, such as admission to intensive care unit (ICU), blood transfusion, or return to an operating room, also constitutes PLTC.

Amniotic fluid embolism (AFE)

Introduction: Amniotic fluid embolism (AFE) is a catastrophic obstetrics complication occurring during labor and delivery or immediately postpartum, and is characterized by sudden cardiovascular collapse, respiratory distress, altered mental status and disseminated intravascular coagulation (DIC). AFE is one of the leading causes of maternal death worldwide [1].

Diagnosis: In women with AFE, we will find that squamous cell and other debris of presumed fetal origin may be found, either at autopsy or pulmonary artery catheter, but is difficult to diagnose early. The early diagnosis of amniotic fluid embolism is clinical, based on the presence of these elements and the exclusion of other likely causes [2].

Clinical Symptoms: The onset time of AFE varied from 10 min to 48 h. Clinical signs and symptoms of AFE are outlined in (Table 1). The manifestations of typical AFE are acute dyspnea and cyanosis, sudden hypotension, cardiac arrest, ventricular fibrillation, ventricular tachycardia or seizures, acute confusion occurred within 10–30 min. Meanwhile, the atypical AFE showed postpartum hemorrhage with DIC as the initial presenting symptom, and usually occurred after delivery or up to 2 days [2].

AFE symptomatology evolution can be divided classically into three phases. The initial phase is characterized by transient pulmonary and systemic hypertension resulting in severe ventilation to perfusion mismatch, hypoxemia, and potentially development of right heart failure. The second phase involves decreased left ventricular function and development of acute pulmonary edema. The third phase is characterized by heart failure, worsening acute lung injury/acute respiratory distress syndrome (ARDS), and coagulopathy [3].

Table 1: Clinical signs and symptoms of amniotic fluid embolism.

Cardiovascular	Respiratory	Hematologic	Neurologic	Obstetric
Hypotension	Respiratory arrest	Coagulopathy	Altered mental	Fetal distress
Cardiogenic shock	Hypoxemia	DIC	status	Uterine atony
Right heart failure	Tachypnea/dyspnea	Hemorrhage	Seizure	
Left heart failure	Pulmonary			
Dysrhythmias	edema/ARDS			
Tachycardia	V:Q mismatch			
Cardiac arrest				

Abbreviations: ARDS: Acute Respiratory Distress Syndrome; DIC: Disseminated Intravascular Coagulation; V/Q: Ventilation/Perfusion

In cases occurring prior to delivery, electronic fetal monitoring will demonstrate decelerations, loss of variability, and terminal bradycardia as oxygenated blood is shunted away from the uterus, and catecholamine induced uterine hypertonus causes a further decline in uterine perfusion.

Laboratory tests*:* The criteria of diagnosis for DIC included thrombocytopenia<100*109/L or a gradually decrease, prolonged prothrombin time (PT) and activated partial thromboplastin time (APTT) with fibrinogen levels <1.2 g/L, or clotting failure, broken red cell in the peripheral blood slide. Otherwise, Platelet count, prothrombin time, fibrinogen, and d-dimer levels were measured to calculate the DIC score. A score of 5 or higher was considered compatible with DIC and a lower score was considered as non-DIC.

Management: The management of AFE is supportive and directed towards maintenance of oxygenation, cardiac output and blood pressure, and correction of the coagulopathy. Initial goal of the treatment is the rapid correction of maternal hemodynamic instability. The treatment ideally operated within an intensive care unit (ICU) by an interdisciplinary team. In case of necessity, aggressive support treatment such as cardiopulmonary resuscitation, uterine evacuation, continuous respiratory/blood pressure monitoring, pulmonary artery catheter, transesophageal echocardiography should be followed.

If patient has no response to cardiopulmonary resuscitation, postmortem cesarean section can be performed during the resuscitation. Recombinant factor VIIa has been used successfully to treat postpartum hemorrhage in patients who do not have high circulating tissue factor concentrations, such as those with uterine atony, uterine rupture, and abnormal placentation. However, it is recommended that recombinant factor VIIa should be considered only in AFE patients when the hemorrhage cannot be stopped by massive blood component replacement. Previous reports also show that patients who received recombinant factor VIIa had significantly worse outcomes [4].

HELLP syndrome and severe preeclampsia

Introduction: Pre-eclampsia is a pregnancy-specific disease characterised by de-novo development of concurrent hypertension and proteinuria, sometimes progressing into a multiorgan cluster of varying clinical features [5]. HELLP syndrome is an acronym for Hemolysis, Elevated Liver enzymes and Low Platelets. It is generally considered in the literature as a particular clinical form of pre-eclampsia, a severe complication of the second half of pregnancy [6]. Sometimes, this syndrome can occur in isolation in the absence of pre-eclampsia symptoms.

Diagnosis:

Clinical Symptoms: Clinicians should take caution not to undervalue clinical signs and symptoms in (severe) pre-eclampsia (Table 2) because they can be no specific (eg, nausea and vomiting). HELLP syndrome complicates 10–20% of cases of severe pre-eclampsia, and develops mostly preterm (50%) [5]. Typical clinical symptoms of HELLP syndrome are pain in the right upper quadrant abdomen or epigastric pain, nausea and

Table 2: Differential diagnoses in severe pre-eclampsia by organ system.

Vasculature Phaeochromocytoma Hyperaldosteronism Cushing's disease Thyrotoxicosis Aorta coarctation	**Respiratory system** Pneumonia Pulmonary embolus (Catastrophic)antiphospholipid syndrome
Renal system Lupus nephritis Acute and chronic glomerulonephritis Interstitial nephritis Pyelonephritis	**Cardiovascular system** Peripartum cardiomyopathy Myocardial infarction or ischaemia
Liver Acute fatty liver of pregnancy Pregnancy cholestasis Hyperemesis gravidarum Cholecystitis Cholangitis Viral hepatitis Acute pancreatitis Gastritis Gastric ulcer	**Brain** Cerebral systemic lupus erythematosus Epilepsy Brain tumour Cerebrovascular accident Hypertensive encephalopathy Metabolic disease
Haemostasis Benign thrombocytopenia of pregnancy Thrombotic thrombocytopenic purpura Haemolytic uraemic syndrome Idiopathic thrombocytopenic purpura Antiphospholipid syndrome Folate deficiency Systemic lupus erythematosus Septic or haemorrhagic shock	**Eyes** Retinal arterial or venous thrombosis Retinal ischaemia Retinal detachment Persistent spasm of retinal vessels Central serous retinopathy Uveal melanoma Choroidal osteoma

vomiting. Pregnant women often report discomfort a few days before the presentation of abdominal pain. Approximately 30–60% of pregnant women have headache and about 20%, visual symptoms. The intensity of symptoms is exacerbated at night [7].

The obstetrician should pay attention to the nuances of the clinical history (pyelonephritis with septicemia, cholecystolithiasis, pancreatic, cocaine intoxication) and the behavior of laboratory abnormalities (viral hepatitis, CIV).

Laboratory tests are also important for HELLP syndrome diagnosis and should always be requested in cases of preeclampsia, eclampsia and in pregnant women with pain in the right upper quadrant of the abdomen.

Currently someone has proposed strict criteria for true HELLP syndrome, platelet count<100 × 109/L, AST ≥ 70 UI/L and LDH ≥ 600 UI/L, besides the data of intravascular hemolysis (observed in the peripheral blood analysis of the microscopic film abnormal), increased serum bilirubin (≥20.5 μmol/L or ≥1.2 mg/100 mL) and elevated LDH levels (>600 U/L).

Class 1 and class 2 are associated with hemolysis (LDH>600 U/L) and elevated AST levels (≥70 U/L), while class 3 requires only LDH>600 U/L and AST ≥ 40U/L in addition to the specific count (platelet count in class 1: <50 × 109/L, class 2:50 × 109/L – 100 × 109/L and class 3 :> 100 × 109/L). Class 3 is considered as a clinical significant transition stage or a phase of the HELLP syndrome which has the ability of progression [7].

Management: Some important observations were made by Dr. Weinstein and are very useful nowadays for pregnant women with HELLP syndrome management [8]. The first observation is that the disease is progressive and the patient does not appear to be sick. The second one highlights hypoglycemia as an important marker of worsening. The third one emphasizes that there is no correlation between platelet count and liver enzyme levels to diagnose HELLP syndrome. The fourth one shows that all record of women who died from HELLP syndrome related complaints of heartburn and pain in the right upper quadrant during the third trimester of gestation and these symptoms were mistakenly treated with drugs not indicated for this syndrome.

So, treatment of HELLP syndrome is based on syndrome symptoms. The unique resolution of the condition is the delivery. Patients with hypertensive crisis should be treated with antihypertensive as nifedipine or hydralazine (Nifedipine capsules are safe to use contemporaneously with $MgSO_4$; nifedipine capsules should not be used in women with known coronary artery disease, aortic stenosis, or longstanding diabetes (eg, >15 years) [7]. At the same time, prophylaxis with magnesium sulfate should be used in schemes. Patients with gestational age less than 34 weeks, clinically stable, may have delayed the delivery by 36 to 48 h, in which they can be benefited from the use of corticosteroids for fetal.

BOX3: Acute fatty liver of pregnancy (AFLP)

Introduction: Acute fatty liver of pregnancy (AFLP) is an uncommon but potentially lethal and elusive complication that occurs in the third trimester or early postpartum period.

Multiple organ dysfunction syndrome (MODS) and associated death is common in such cases.

Researchers suggested that AFLP may be related to increased estrogen, metabolism, disturbance of fatty acid. It is reported that being primigravida, having had multiple pregnancies, carrying a male fetus, and experiencing preeclampsia are the high-risk factors for AFLP [9**]**.

Diagnosis: Because the initial symptoms of AFLP are atypical and could be neglected, and because this disease develops rapidly and causes multisystem dysfunction in a very short time, it is important to be especially vigilant for its development [10].

So, AFLP should be highly suspected when the following clinical conditions occur:

Clinical symptoms: (i) gastrointestinal symptoms, which include nausea, vomiting, fatigue, and vague abdominal pain, appearing in late pregnancy without obvious reason; (ii) jaundice occurring after gastrointestinal symptoms and promptly becoming worse; (iii) liver dysfunction occurring in late pregnancy, when other hepatic diseases have been excluded; (iv) hypertensive disorder complicating pregnancy associated with hypoglycemia, hypofibrinogenemia, and increased prothrombin time; (v) maternal coagulation dysfunction complicated with fetal distress in late pregnancy without definitive reason;

Laboratory tests: (i) laboratory examination showing obvious leukocyte elevation, decreased red blood cells and platelets, elevated total bilirubin, especially direct bilirubin, and an increase in hepatic aminotransferase levels (ALT, AST) from mild to moderate (the variable range was reported from normal to 1000 U/L and seldom over 500 U/l; and (ii) ultrasound scan of a fatty liver showing increased echogenicity ('bright liver'), and a CT indicating decreased liver density

Management: Once AFLP is diagnosed or highly suspected, pregnancy should be terminated as soon as possible, regardless of whether the condition is mild or severe or the course is early or late. Some researchers [11] reported that if the interval from occurrence of AFLP to delivery was one week, 100% of patients survived. If the interval from the occurrence of AFLP to delivery was more than 2 weeks, 30% (1/3 of patients) died the same day or the day after delivery. Therefore, timely termination of pregnancy is crucial in the treatment of AFLP. Furthermore, we suggest that cesarean section is the preferred method to terminate pregnancy if vaginal delivery cannot be performed promptly. In addition, before surgery, it is important to supplement fresh frozen plasma, platelets, and packed red blood cells for patients with coagulation dysfunction to reduce blood loss. Because the probability of postpartum hemorrhage is high, hysterectomy and uterine artery embolization should be considered at the time of pregnancy termination.

In recent years, liver transplantation and human fetal liver cell transplantation have been used to treat AFLP with a great deal of success. However, some researchers have applied artificial liver support systems, such as the molecular absorbents recirculating system and plasma exchange, to treat AFLP with good results. Furthermore, after delivery, supportive treatment and close observation are required.

RESULTS

Multiple regression analysis was used to identify factors associated with the occurrence of maternal near-miss morbidity or mortality (Table 3). Women who had no health insurance (aOR: 4.55; 95%, CI: 0.87–21.8) and had fewer than 6 prenatal consultations (aOR: 6.76; 95%, CI: 0.76–45.8) were more likely to experience near-miss morbidity or death, and accounted for 92.6% and 90.7% of all cases of near-miss morbidity and death, respectively. These risk factors were also found to be prevalent in the migrant population versus the non-migrant population (aOR: 2.34; 95%, CI: 0.45–24.9). Besides, we also conducted a survey about the social and economic factors associated with maternal death morbidity between 2011 to 2013 [12]. This survey may prove this conclusion (Table 4). Migrants tended to have no fixed work and no regular visits to doctors; thus, compared with the nonmigrant population, they provided less information about their health history when they encountered serious illness. A delay in seeking healthcare by those who experienced severe morbidities was found to be a negative factor that was significantly associated with disease progression [13].

There were several hospital-related risk factors, including delays in starting adequate treatment after arrival at the hospital, delays in accurate diagnosis of disease, and delays in carrying out emergency surgery or other rescue procedures that might prevent less severe morbidity developing into near-miss morbidity or even death.

Among the women classified as near-miss morbidity or mortality, 31 (40%) were admitted to the ICU (aOR: 6.75; 95%, CI: 0.89–34.6) and 32 (49.2%) were given blood products within 30 min (aOR: 3.79; 95%, CI: 0.65–8.67), which-as life support procedures-were necessary to prevent death. There was a high prevalence of delivery by cesarean in the overall group, but this was not significantly associated with perinatal mortality.

CONCLUSION

Besides all these therapies mentioned above, a continuing training and education program can be launched for obstetric and midwifery staff to enable them to take prompt steps in severe cases of morbidity. Efforts to reduce maternal death from severe acute maternal morbidities must abide by clear and up-to-date evidence-based protocols. Last but not least, the reduction in severe morbidities and maternal deaths might be best achieved by developing high-quality surveillance programs and rapid referral systems for women with pregnancy morbidities.

Table 3: Factors associated with maternal and near-miss morbidity.

Factors	Death plus near miss-cases(n=72)	PLTC(n=136)	P-value	Crude OR (95% CI)	aOR (95% CI)
Age>35y	11 (15.2)	16 (11.7)	0.11	1.28(0.45-4.67)	1.87 (0.67–7.46)
Gestational age<34 wk	36 (50)	51 (37.5)	0.15	1.35 (0.33–5.56)	1.53 (0.43-8.78)
No health insurance	63 (92.6)	74 (60.2)	0.02	1.57 (0.47–7.45)	4.55 (0.87–21.8)
Multiparity	53 (73.6)	87 (63.9)	0.22	1.07 (0.36–9.57)	1.45 (0.53–9.56)
<6prenatal consultations	59 (90.7)	63 (50.4)	<0.001	2.36 (0.56–45.7)	6.76 (0.76–45.8)
Migrant population	54 (75.0)	47 (34.5)	0.01	3.43 (0.45–23.8)	2.34 (0.45–24.9)
Transferred from lower-level facility	15 (20.8)	21 (15.4)	0.56	1.23 (0.26–3.76)	1.54 (0.35–5.78)
Delivered outside hospital	7 (9.7)	4 (2.9)	0.76	0.79 (0.34–4.15)	0.67 (0.48–5.19)
Previous cesarean delivery	9 (12.5)	13 (9.5)	0.35	1.25 (0.36–3.57)	1.29 (0.43–3.89)
Current cesarean delivery					
Delay in seeking healthcare	62 (86.1)	65 (47.7)	0.46	1.78 (0.48–6.67)	1.46 (0.37–5.67)
Delay in diagnosis	24 (38.7)	11 (9.1)	<0.001	3.67 (0.57–9.67)	4.76 (0.89–13.6)
Admission to ICU	9 (13.2)	12 (9.2)	0.21	2.54 (0.52–7.95)	2.37 (0.68–6.74)
Blood transfusion within 30 min	31 (40.0)	8 (5.8)	0.01	5.57 (0.87–24.8)	6.75 (0.89–34.6)
	32 (49.2)	19 (12.5)	<0.001	3.67 (0.54–7.68)	3.79 (0.65–8.67)

Abbreviations: aOR: Adjusted Odds Ratio; CI: Confidence Interval ICU: Intensive Care Unit; MNM: Maternal Near Miss; PLTC: Potentially Life-Threatening Conditions.
P-value<0.05 has statistical significance

Table 4: The social and economic factors associated with maternal death morbidity (%).

YEARS	Migrant population		Health insurance		Prenatal consultations	
	Yes (%)	No (%)	Yes (%)	No (%)	Yes (%)	No (%)
2011	7(100)	0(0.00)	2(28.57)	5(71.43)	1(14.29)	6(85.71)
2012	5(71.43)	2(28.57)	1(14.29)	6(85.71)	2(28.57)	5(71.43)
2013	3(75.00)	1(25.00)	1(25.00)	3(75.00)	0(0.00)	4(100.00)
TOTAL	15(83.33)	3(16.67)	4(22.22)	14(77.78)	3(16.67)	15(83.33)
P-value	<0.05		<0.05		<0.05	

P-value<0.05 has statistical significance

However, we believe that governments should have a larger role in preventing maternal near misses and deaths in low-resource countries. The United Nations advocates that governments should take measures to guarantee basic human rights for the safety of mothers. Apart from more financial investment in basic health infrastructure or subsidies, there should be more comprehensive support for pregnant women in different communities. An effective strategy might be a surveillance system with rapid referral procedures within different levels of healthcare facilities. Most severe morbidities are preventable if appropriate treatment is given at an early stage of the disease. Thus, community-level interventions in perinatal care practice can bring about a reduction in maternal mortality.

REFERENCES

1. Shen F, Wang L, Yang W, Chen Y. From appearance to essence: 10 years review of atypical amniotic fluid embolism. Arch Gynecol Obstet. 2016; 293: 329-334.
2. Society for Maternal-Fetal Medicine (SMFM) with the assistance of. Electronic address: pubs@smfm.org, Pacheco LD, Saade G, Hankins GD, Clark SL. Amniotic fluid embolism: diagnosis and management. Am J Obstet Gynecol. 2016.
3. Sultan P, Seligman K, Carvalho B. Amniotic fluid embolism: update and review. Curr Opin Anaesthesiol. 2016; 29: 288-296.
4. Knight M, Fitzpatrick K, Kurinczuk JJ, Tuffnell D. Use of Recombinant Factor VIIa in Patients with Amniotic Fluid Embolism. Anesthesiology. 2012; 117: 423-424.
5. Steegers EA, von Dadelszen P, Duvekot JJ, Pijnenborg R. Pre-eclampsia. Lancet. 2010. 376:631-44.
6. Medhioub Kaaniche F. Up-to-date on the HELLP syndrome (Hemolysis, Elevated Liver enzymes and Low Platelets. Rev Med Interne. 2016.
7. Dusse LM, Alpoim PN, Silva JT, Rios DR, Brandão AH, Cabral AC. Revisiting HELLP syndrome. Clin Chim Acta. 2015; 451: 117-20.
8. Weinstein L. Syndrome of hemolysis, elevated liver enzymes, and low platelet count: a severe consequence of hypertension in pregnancy. Am J Obstet Gynecol. 1982; 142:159-167.
9. Yazhen H, Youguo C, Genda P. Acute Fatty Liver of Pregnancy:Clinical Analysis of 20 cases. Journal of Practical Obstetrics and Gynecology. 2010; 26: 767-69.
10. Wei Q, L. Zhang, Liu X, Clinical diagnosis and treatment of acute fatty liver of pregnancy: a literature review and 11 new cases. J Obstet Gynaecol Res. 2010; 36:751-6.
11. Vanlak D MR, Roche-Sicot J, Soulier A, Sicot C, Acute fatty liver of pregnancy a clinical study of 12 episodes in 11 patients. Gastroenterology, 1991. 100: p. 1123-1125.
12. Wang L. Critical Maternal Referral Network Construction and Evaluation of the Interventions of Suzhou. Maternal and Child Health Care of China. 2014; 32: 4.
13. Shen FR, Liu M, Zhang X, Yang W, Chen YG. Factors associated with maternal near-miss morbidity and mortality in Kowloon Hospital. Int J Gynaecol Obstet. 2013; 123: 64-67.

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