

Original Article

Clinical characteristics and outcomes of eclampsia patients admitted to the intensive care unit of China

Li-Na Zhang^{1,2}, Yi-Lei Xiao³, Tie-Jun Wu², Yan-Jun Liu⁴, Da-Wei Wu¹

¹Department of Intensive Care Unit, Qilu Hospital, Shandong University, Jinan, Shandong, China; ²Department of Intensive Care Unit, Liaocheng People's Hospital and Liaocheng Clinical School of Taishan Medical University, Liaocheng, Shandong, China; ³Department of Neurosurgery, Liaocheng People's Hospital and Liaocheng Clinical School of Taishan Medical University, Liaocheng, Shandong, China; ⁴Department of Gynecology and Obstetrics, Liaocheng People's Hospital and Liaocheng Clinical School of Taishan Medical University, Liaocheng, Shandong, China

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Abstract: Aim: To understand the clinical characteristics of eclampsia women and postpartum health status of mother and baby in China. Method: Retrospective analysis was made on 165 cases of eclampsia patients admitted to three municipal hospitals in Shandong, China, concerning their conditions on admission, rescue process, complications, mechanical ventilation, time in ICU and postpartum condition of mother and baby. Result: Among the eclampsia patients, 126 cases are antenatal eclampsia, 27 cases are postpartum eclampsia and 12 are both antenatal and postpartum eclampsia. Antenatal eclampsia cases suffered bad feelings such as headache, dizziness and blurred vision, etc. one hour to 7 days before tic, but this did not attract attention. 117 cases of the antenatal eclampsia cases were transferred from their local county hospital and during transfer 97 suffered tic again. 126 cases are pregnant women at normal age. Group of pregnancy weeks ≥ 37 , Percentage of first pregnancy women and Apgar score of newborn babies are significantly higher than group of pregnancy weeks < 34 . Age of pregnant women, percentage of mechanical ventilation cases, time in ICU are all lower than group of pregnancy weeks < 34 . Craniocerebral CT or MRV after operation found positive results in 90.5% of the examination undertakers. Conclusion: Eclampsia cases are mainly pregnant women aged 25-35. High-age and second-pregnancy women have shorter pregnancy period. Pregnant women and baby have an obviously better condition than those with pregnancy weeks < 34 . Craniocerebral examination should be given to eclampsia patients for cerebrovascular diseases and be diagnosed as early as possible.

Keywords: Intensive care unit, high blood pressure during pregnancy, eclampsia, venous sinus thrombosis

Introduction

Eclampsia is the severe stage of high blood pressure during pregnancy. Patients suffer high blood pressure, tic, lack of oxygen, thus affecting mother and baby seriously. It is an important cause of death. Pregnant women suffer aspiration pneumonia, blood coagulation dysfunction, cerebrovascular disease, infection, multiple organ dysfunction, etc., and they need to be transferred to ICU [1]. According to a research in Turkey, severe pre-eclampsia sufferers and eclampsia cases take up 73.6% of ICU maternity ward patients and among them about 20% are eclampsia cases [2]. Research from Spain finds that eclampsia patients take up 6% of ICU maternity ward patients.

Reduction of the death rate of pregnant women is a global aim. In 2013 World Health Organization carried out a retrospective analysis of severe pre-eclampsia and eclampsia [3]. The research concerned 40 countries, and it is found that from 2002 to 2010 the average morbidity of severe pre-eclampsia and eclampsia among pregnant women is 4.6% and 1.4% respectively. But this differs in different regions. Morbidity of eclampsia ranges around 0.1%-2.9%. In developed European and west Pacific countries, morbidity is 0.1% whereas in Africa it is 2.9% and death rate of pregnant women from eclampsia is 8.3%. It is found that data about severe pre-eclampsia and pre-eclampsia is scarce, and only 11 countries have carried out relative statistic analysis. So it is impossible to

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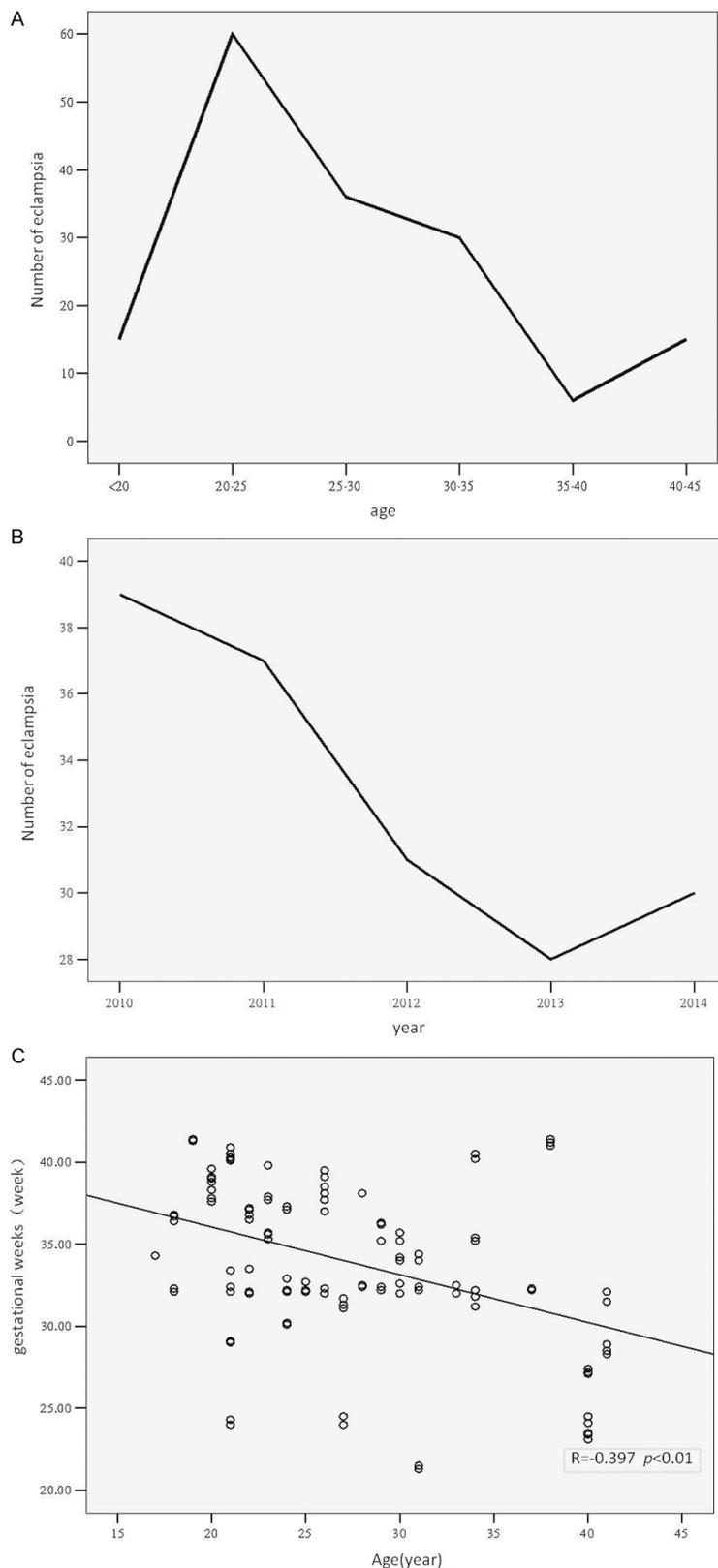


Figure 1. A. Number of eclampsia cases admitted to ICU from 2010 to 2014. B. Relation between case and age in eclampsia patients: X-axis is age and Y-axis is number of case. C. Negative relation between age and gestational weeks ($r = -0.397$, $P < 0.01$).

show the incidence feature of the disease. And in China there is no epidemiology data about the disease, so research in this field should be strengthened.

In this research retrospective analysis was made on 165 cases of eclampsia patients admitted to three municipal hospitals in Shandong, China, concerning their general conditions on admission, clinical characteristics, complications, mechanical ventilation, time in ICU and postpartum condition of mother and baby. And this research aims to understand to a certain extent the clinical characteristics of eclampsia in China and prognosis of mother and baby.

Materials and methods

Retrospective analysis was made on 165 cases of antenatal and postpartum eclampsia patients admitted to ICU in three municipal hospitals in Shandong, China (Liaocheng People's Hospital, Binzhou People's Hospital and Jining People's Hospital), aged 17-41 years and 26.7 ± 6.69 on average. Incidence time was week 24 after pregnancy to day 6 after delivery. All patients showed signs of eclampsia [4]: ① blood pressure $\geq 140/90$ mmHg ($1 \text{ mmHg} = 0.133 \text{ kPa}$) at week 20 after pregnancy; ② urine protein $\geq 300 \text{ mg}/24 \text{ h}$ or showing (+); ③ tic and/or coma during pregnancy or after delivery and no other reason for this. Complications such as hemolytic anemia, elevated liver enzymes, low platelet (HELLP) syndrome, Heart failure, Multiple organ dysfunction syndrome (MODS), Infection were also detected. This research adheres to medical ethics and was permitted by the hospital ethical commission.

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Table 1. General condition of eclampsia patients

General condition variable		Percentage or ($\bar{x} \pm s$)
Age (years)	17-41	26.7 \pm 6.69
Peasants (persons)	150	90.9%
Gestational week (weeks)	24 ⁺¹ -41 ⁺²	34 ⁺¹ \pm 4 ⁺⁵
Primipara (cases)	87	52.7%
Twins or multiple births (cases)	18	10.9%
Time span from previous pregnancy (year)	4-12	6.89 \pm 2.85
Admission systolic blood pressure (mmHg)	145-220	166 \pm 24.9
Admission diastolic blood pressure (mmHg)	88-160	108 \pm 17.9
Tic during transference (cases)	97	76.9%
Times of tic	1-5	2.07 \pm 1.31
Time from first tic to admission (h)	1-21	4.72 \pm 4.00
APACHE II score	6-19	9.5 \pm 2.8
HELLP syndrome (cases)	9	5.5%
Heart failure (cases)	6	3.6%
Multiple organ dysfunction (cases)	9	5.4%
Infection (cases)	15	9.1%
Mechanical ventilation (cases)	57	34.5%
Days in ICU	1-11	3.8 \pm 1.9

We collected the data of general information such as age, Pregnancy time, first pregnancy or not, multiple births or not, time span from previous pregnancy, admission blood pressure (mmHg), tic during transference, times of tic, time from first tic to admission; and data after patient in ICU such as APACHE (Acute Physiology and Chronic Health Evaluation) II score, complications such as HELLP, heart failure, MODS, infection, days in ICU, cerebrovascular complications of patients; also we collected data of baby such as Apgar score.

All data were analyzed on SAS 9.0 and data were represented by means \pm SD. Groups were compared to each other by t-testing or single factor variance analysis and multiple comparison of sample rate. Correlation analysis was made by Spearman rank correlation test, and difference is significant on $P < 0.05$.

Results

165 cases of eclampsia patients were admitted to the three hospitals in 5 years (**Figure 1A**), among whom 126 were antenatal eclampsia, 27 were postpartum and 12 were both antenatal and postpartum. Their age ranged from 17 to 41, and 90.9% were women at week 24⁺¹-41⁺² after pregnancy. 61.8% were pregnant for first time and 10.9% belonged to twins or multiple births. Second pregnancy women had a

time span of 4-12 years from first pregnancy. On admission systolic blood pressure was (145-220) mmHg, and diastolic blood pressure was (88-160) mmHg. 76.9% had tic again during transference and total tic times were 1-5, and time between incidence of the disease and admission was 1-21 hours. APACHE II score was 6-19. Rate of HELLP syndrome, heart failure, multiple organ dysfunction and infection was 5.4%, 3.6%, 5.4%, 9.1% respectively. 34.5% had mechanical ventilation. Time in ICU was 1-11 days (**Table 1**).

126 cases (76%) of 165 eclampsia patients were women aged between 25-35

year, 15 cases <20 years (9%) and 21 cases >35 years (12.7%) (**Figure 1B**). Eclampsia patients were divided into three groups according to gestational weeks: <34 weeks, 34-36⁺⁶ weeks and ≥ 37 weeks, 78 cases, 33 cases 54 cases for each group respectively. Ages of ≥ 37 group were obviously lower than <34 group, and percentage of first pregnancy was obviously higher than <34 group (**Table 2**). Correlation analysis of gestational weeks and ages found negative correlation between them ($r = -0.397$, $P < 0.01$, **Figure 1C**). 18 cases of stillbirth were all multipara, gestational weeks <28. Group of gestational weeks ≥ 37 had higher Apgar score for newborn babies than group of gestational weeks <34 ($P < 0.05$). Percentage of mechanical ventilation and time in ICU were both lower than group of gestational weeks <34 ($P < 0.05$ or $P < 0.01$) (**Table 2**).

Most cases of eclampsia were antenatal, and the number is 126 whereas postpartum cases were 27. 12 cases were both antenatal and postpartum. Age of the three groups was not significantly different. Gestational weeks of both antenatal and postpartum cases were obviously longer than antenatal eclampsia patients. APACHE II score, time in ICU and cerebrovascular disease condition were not significantly different (**Table 3**).

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Table 2. Comparison of onset age, primipara proportion, baby condition and index in ICU between eclampsia patients in different groups

Group	Cases (n=165, %)	Age (mean ± SD)	Primigravid (n=87, %)	Apgar (mean ± SD)	APACHE II (mean ± SD)	ventilation cases (n=60, %)	ICU time (mean ± SD)
<34 (n, %)	78 (47.3)	29.0±7.28	33 (37.93)	5.7±2.7	9.42±2.37	36 (60)	4.38±2.29
34-36 ⁶ (n, %)	33 (20)	25.5±6.04	15 (17.24)	7.6±2.7	10.4±3.81	18 (30)	3.70±1.25
≥37 (n, %)	54 (32.7)	24.3±5.04*	39* (44.83)	7.8±3.6*	9.16±2.81	6 [#] (10)	2.94±1.51*

Compared to <34 group, *: P<0.05, #: P<0.01.

Table 3. Comparison of age, gestational weeks, APACHE II score, ICU time and rate of cerebrovascular disease between different groups of eclampsia patients

Group	Cases	Age	Gestational weeks	APACHE II score	ICU time	cerebrovascular complication
Antenatal	126	26.9±6.97	32.93±4.21	9.09±2.25	3.73±1.91	51
Postpartum	27	25.6±5.75	37.03±6.57	10.56±3.50	4.00±2.59	6
Antenatal+postpartum	12	27.5±7.14	38.35±2.48*	11.5±5.26	3.75±1.50	0

*: Compared to antenatal eclampsia group, P<0.05.

Table 4. Brain imaging and cerebrovascular disease condition of patients with different consciousness

GCS	Total	Brain examination (%)	Abnormal (%)	Cerebral hemorrhage	Sagittal sinus thrombosis	Other
≥12	123	26.8	90.9	0	21	9
<12	42	71.4*	90.0	3	9	15

GCS: Glasgow Coma Scale; *: P<0.05.

Table 5. ICU time and time in wards after transference between patients transferred to maternity ward and neurology ward

Ward after transference	Cases	ICU time	Time in hospital after leaving ICU
Maternity ward	99	3.42±1.62	5.85±1.91
Neurology ward	45	3.94±1.84	8.13±4.03*

*: P<0.05.

Whether brain imaging was undertaken depended on several factors, such as clinical conditions, economic condition of patients, doctors' different clinical experiences and decision, etc. According to patients' consciousness within 24 hours after admission, eclampsia patients were divided into two groups: group of GCS (Glasgow Coma Scale) ≥12 and group of GCS <12. Percentage of patients taking brain imaging was higher in GCS <12 group than in GCS ≥12 group (P<0.05). But rate of cerebrovascular disease was not significantly differently between the two groups that undertook brain image (Table 4).

When patients' vital signs improved in ICU, they were transferred to different wards (mostly

maternity wards and neurology wards) according to condition and complications. In this research 99 cases (60%) were transferred to maternity wards, 45 cases (27%) to neurology wards, and others to cardiology or liver disease department. After comparing patients transferred to maternity ward and neurology ward, it was found their ICU time was not significantly different. But time of staying in neurology ward for patients with incidence of cerebrovascular disease was longer

than time of staying in maternity ward for those transferred here (P<0.05) (Table 5).

Discussion

Eclampsia is the severe stage of pregnancy-induced hypertension syndrome, and it affects the health of mother and baby severely. Preeclampsia, thromboembolic disease, postpartum hemorrhage are the three major causes of maternal death [5]. A retrospective research [6] in Australia showed that preeclampsia morbidity is 2.3-4.6% in all pregnant women and it is decreasing year by year whereas eclampsia morbidity is 8.6/10,000 parities. Incidence rate of eclampsia in preeclampsia is 2.3-4.2% and the rate is increasing. Therefore, in clinical

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work the diagnosis and treatment of eclampsia is very important. China is on the way of transforming economic development patterns, and eclampsia morbidity is high. But clinical data is scarce. This is caused by the imbalanced eclampsia distribution and medical equipment supply. Eclampsia is mainly caused by the fact that pregnancy-induced hypertension patients do not take regular antenatal examination and do not pay enough attention to possible clinical symptoms, thus worsening the disease. Therefore, eclampsia mainly takes place in under-developed countryside or towns in China. In township hospital medical resource is scarce and limited and treatment experience is relatively low, and patients often need to be transferred to superior-level hospital. Not to mention statistical research about the disease. In provincial hospitals, medical and research conditions are better, but clinical cases are fewer due to the consciousness to disease and better economic condition of the city people. In this research, the three city-level hospitals represent regional level-three comprehensive hospitals and they serve the neighboring countryside and city people. The etiology and disease group of eclampsia can scientifically reflect the characteristics of the disease in this area. All eclampsia patients in the three hospitals were transferred to ICU after operation and this has a special advantage in studying this disease.

There are total 116 beds in the ICU of the three hospitals, and in 5 years hospitalized patients totaled 21750 among whom 1692 cases were from maternity ward, 783 cases severe preeclampsia, and 165 cases eclampsia. The vast majority (90.9%) of eclampsia patients were farmers, and they did not take regular antenatal check, and came to hospital after incidence of eclampsia. The spiritual and economic stress of peasants, the long interval between two pregnancies, multiple births, the winter gestation are considered as the factors of pregnancy-induced hypertension syndrome. Chinese farmers live under big pressure, and because of factors such as family planning, long interval between two pregnancies, high possibility of multiple births due to unreasonable use of fertility drugs and irregular checking etc. have raised the incidence of pregnancy-induced hypertension syndrome and eclampsia. Our statistics found there is a time span of 4-12 years between the patients' pregnancy and their previous gestation. About 10% of the

cases are twins. It can be seen that eclampsia remains an economy-related disease, and knowledge about it should be spread in rural areas. Strengthening antenatal care, early detection of pregnancy-induced hypertension syndrome and prevention of eclampsia is the fundamental measure.

At present China's grass-roots hospitals cannot effectively cope with severe diseases of pregnancy. In this research 92.9% of the patients were transferred from local county hospitals, and 76.9% had recurrent tic during transference in route. Tic before admission was 1 time or as many as 5 times. First tic took place 1-21 hours before admission. Frequent and long-time tic adds to the risk of maternal and neonatal hypoxia and it is important for us to increase the coping capacity of grass-roots hospitals and reduce unnecessary transfers, while preventing the occurrence of tic during transference.

Obstetric management and comprehensive monitoring of ICU and emergency treatment are the key to ensuring successful rescue of the women in severe conditions before and after delivery [7, 8]. A study in 2003 found that [2], most of obstetric patients in ICU were severe preeclampsia and eclampsia patients. The percentage is 73.6%, followed by postpartum hemorrhage, accounting for about 11.2%. In this study patients with severe preeclampsia and eclampsia takes up 56% of obstetric patients in ICU. They were integrated into the ICU after childbirth, greatly improving the maternal life. In the 3 hospitals, process and treatment of eclampsia were emergency department → obstetric department → ICU or emergency department → ICU → obstetric department. In this research 129 cases were antenatal eclampsia, 21 cases of them were accepted by ICU on admission, tic was controlled favorably and then uterine-incision delivery was given. 108 cases were first accepted by obstetric department, 78 cases of them were transferred to ICU when tic was controlled and pregnancy was stopped, 30 cases of them did not control tic successfully and then transferred to ICU to control tic. Among the patients whose tic was not controlled successfully, 6 cases had postpartum eclampsia and 3 cases had superior sagittal sinus thrombosis. This shows that antenatal eclampsia cannot be easily controlled and patients are subject to potential danger.

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Making a reasonable diagnosis and treatment processes and strengthening the joint treatment of obstetric department and ICU is critical for ensuring the safety of eclampsia patients. We believe that emergency department → ICU → obstetric department is the proper process to ensure life security of eclampsia patients.

Pregnancy-induced hypertension is the fundamental cause of eclampsia. The fundamental treatment is to stop pregnancy. When pregnancy is stopped, blood pressure can be reduced, thus decreasing the possibility of repeated tic. In recent years, studies have shown that [4] cesarean section is an important method to rescue eclampsia patients. To improve the condition of mother and baby, it is unnecessary to stop pregnancy 2 hours after tic is stopped. Cesarean section can be done according to actual conditions and sometimes the cesarean section and rescue be carried out at the same time. Antenatal eclampsia patients were mostly transferred from other hospitals. The time from first tic to admission is long (4.72 ± 4.00 hours) and repeated tic was common. 3 cases were stillbirth, 3 cases were abortion, and 2 cases had fully opened uterine neck and natural birth was undertaken. Other patients had cesarean section to protect both mother and baby.

Eclampsia patients suffer chronic hypoxia in pregnancy, thus causing fetal distress and growth retardation to baby. And insufficient gestational age, twitching anoxia cause further damage. Many scholars call early preeclampsia that happens before gestation week 34. According to gestational weeks of patients, we divided the patients into three groups: <34 , $34-36^{+6}$, ≥ 37 . From the statistics we can see that pregnant women at group ≥ 37 weeks women are the youngest, and percentage of first marriage is the highest. That is to say gestational weeks of young and first-pregnancy women are obviously longer than older and second-pregnancy women. The shorter the gestation is, the more severe damage to baby is. 18 cases of stillbirth all took place in women whose gestational weeks <28 . Baby score for group of gestational weeks <34 was significantly lower than group of gestational weeks ≥ 37 , and the proportion of mechanical ventilation and ICU treatment time were longer.

According to the incidence stage of tic, we divided patients into three groups: antenatal,

postpartum, both antenatal and postpartum. Most patients are antenatal eclampsia. In the group of both antenatal and postpartum eclampsia, gestational weeks are the longest. In the three groups, age of pregnant women, APACHE II score, time in ICU and incidence rate of cerebrovascular disease are not significantly different from each other. Postpartum eclampsia is mostly caused by pain after operation, invasive treatment, ineffective control of blood pressure and existence of other complications, and should be paid attention to [9].

Pregnancy-induced hypertension may be combined with many complications, such as cardiac insufficiency, liver and kidney dysfunction, blood coagulation dysfunction, placental abruption, HELLP syndrome, cerebrovascular disease, etc. [10]. Incidence rate of HELLP syndrome among severe preeclampsia patients is 4%-12% [11]. Incidence of cardiac insufficiency among preeclampsia patients is 6-9% [12]. In our research, incidence rate of HELLP syndrome among eclampsia patients is 5.5%, incidence of cardiac insufficiency among eclampsia patients is 3.6%, and incidence rate of multiple organ dysfunction is 5.4%. It is worthwhile to note that incidence rate of cerebrovascular complications is high. In the research, 90% that undertook brain imaging showed positive. Research showed that MRI of eclampsia patients indicated vasogenic brain edema is the main change of eclampsia patients in imaging, and some patients may also have cytotoxic brain edema or brain hemorrhage, and most are reversible [13, 14]. Death rate of eclampsia patients is largely increased due to concurrent hypoxic ischemic encephalopathy or intracranial hemorrhage [15]. In our research we comprehensively considered the health and economic conditions of patients and CT or MIR examination was mostly carried out for patients with consciousness dysfunction 24 hours after transference to ICU, such as dizziness or uneasiness. Research showed death rate of eclampsia is 10.5%, and GCS score can show the death danger of eclampsia to a certain extent [16]. According to consciousness degree of patients 24 hours after transferred to ICU, 42 cases were in group of GCS <12 , among whom family of 12 cases refused examination and other 30 cases undertook examination. The positive rate of cerebrovascular accident was 90%: 3 cases undertook CT and showed large cerebral hemorrhage and died with no

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operation opportunity, 9 cases had superior sagittal sinus thrombus, other 15 had cerebral ischemia or infarction. Some of patients in group of GCS ≥ 12 undertook examination and it was found that positive rate of cerebrovascular disease was 91% among the 31 cases that undertook examination. 21 cases had superior sagittal sinus thrombus, 9 cases had other cerebral ischemia or infarction. Examination rate of consciousness disorder was higher than patients with no consciousness disorder, but both had a high positive rate, showing cerebrovascular disease may exist even without obvious consciousness disorder. Therefore, whether consciousness disorder exists in eclampsia patients or not, brain imaging should be carried out, especially brain MRI. But this may lead to excessive examination or excessive treatment.

Patients were transferred to different wards from ICU when conditions improved. For example, patients with cerebrovascular complications were transferred to neurology department, patients with cardiac lesions or dysfunction were transferred to cardiovascular department, patients with kidney dysfunction were transferred to renal department, patients with liver dysfunction were transferred to liver disease ward. Patients in our hospital were mainly transferred to obstetric or neurology department. Out of ICU, treatment time of patients transferred to neurology department due to cerebrovascular disease was longer than that of patients transferred to obstetric department ($P < 0.05$). Ultimate prognosis of patients was satisfactory. Except three cases of large-area cerebral hemorrhage and one case of left headache from sagittal sinus thrombus, all recovered and left hospital. Whether these patients had headache or cerebrovascular sequelae in prognosis needs to be studied further.

Conclusion

Eclampsia is an economy-related disease in China, and antenatal eclampsia is its main form. Abnormal performance occurs several hours or several days before eclampsia incidence, and knowledge about it should be spread among pregnant and maternal women. It is important to make proper rescue and admission process for eclampsia patients. We think emergency department \rightarrow ICU \rightarrow maternity department is the proper treatment process. Patients who have consciousness retar-

ation 24 hours after operation should undertake cerebral CR or MRI examination to clarify cerebrovascular disease.

Disclosure of conflict of interest

None.

Address correspondence to: Dr. Da-Wei Wu, Department of Intensive Care Unit, Qilu Hospital, Shandong University, Jinan, Shandong, China. E-mail: wudweagd@sina.com

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