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Case Report

Multidisciplinary management of a pregnant woman with hepatic rupture complicated with HELLP syndrome

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Abstract: A 32-year-old woman with preeclampsia who presented with persistent severe hypertension and epigastric pain underwent an emergency cesarean section for fetal distress and was diagnosed with hepatic rupture and HELLP (hemolysis, elevated liver enzymes, and a low platelet) syndrome. After the operation, the patient was transferred to the intensive care unit for supportive treatment and management of complications. Diagnosis and treatment decisions were made through multidisciplinary management. The patient received plasma exchange and continuous renal replacement therapy. One week after the operation, the patient developed deep vein thrombosis and received anticoagulant therapy, which triggered rebleeding. Conservative treatment was taken, including halving the dosage of anticoagulant medication and performing a blood transfusion, and the patient's condition gradually stabilized. The patient was discharged 44 days after the operation. Early diagnosis, effective treatment, and multidisciplinary management can help patients with this critical presentation achieve good clinical outcomes.

Keywords: Hepatic rupture, HELLP syndrome, preeclampsia, multidisciplinary management

Introduction

HELLP (hemolysis, elevated liver enzymes, and a low platelet) syndrome is a severe form of preeclampsia associated with increased maternal morbidity and mortality [1]. The most common clinical manifestations are abdominal pain and pain in the middle of the upper abdomen, right upper abdomen, or below the sternum. The diagnosis in this case was based on laboratory abnormalities. The diagnostic criteria included lactate dehydrogenase (LDH) ≥600 U/L, aspartate transferase (AST) and alanine transferase (ALT) that increased more than 2 times the upper limit of the normal range, and platelet count (PLT) $<100\times10^9$/L [1]. Fetal delivery is the basis and the only effective treatment for HELLP. The clinical treatment of HELLP patients with serious complications is extremely challenging. Subcapsular liver hematoma is a rare but potentially life-threatening condition with an incidence of 1:25,000-40,000. Most cases of subcapsular liver hematoma co-occur with preeclampsia and HELLP syndrome [2]. However, its incidence is only 0.9-1.6% in the entire HELLP patient population [3, 4]. Hepatic rupture is the most serious complication of subcapsular liver hematoma and may have disastrous consequences, especially when not promptly recognized. Maternal mortality from hepatic rupture is high, ranging from 17% to 59%, and usually depends on whether the hematoma is ruptured, the rapidity of diagnosis, and the effectiveness of treatment [2]. Here, we report the case of a pregnant woman with hepatic rupture complicated with HELLP syndrome, showing the whole process of the occurrence and development of the disease in detail, and focusing on the surgical experience, supportive treatment, and management of postoperative complications, to have a more comprehensive understanding of the serious complication of hepatic rupture and enhance vigilance, and to provide experiences and lessons for early identification and effective treatment.

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Case presentation

A 32-year-old woman, G4P1, at 28 + 6 weeks gestation, was admitted with preeclampsia. Her blood pressure was 176/104 mmHg, and she complained of headache. Laboratory tests showed that her hemoglobin (Hb; 105 g/L), aminotransferase level, and PLT were within normal ranges, and her urine protein level was 3+. Ultrasound examination showed fetal growth restriction with an elevated fetal umbilical artery Doppler index (S/D: 3.6-4.5), decreased middle cerebral artery pulsatility index (PI: 1.5, resistance index: 0.78), and estimated fetal weight of 1,013 g (<3rd percentile). The nonstress test showed a reactive type. The patient received rapid-acting nifedipine and a loading dose of magnesium sulfate, after which her blood pressure plateaued to 132/83 mmHg and her headache resolved. She also received dexamethasone to promote fetal lung maturation.

That night, the patient's condition deteriorated. Her blood pressure rose to 188/127 mmHg, and she developed nausea and epigastric pain. Her abdominal pain was initially mild and was thought to be due to gastritis. She received omeprazole intravenous drip because she had a similar experience in previous pregnancies. However, her epigastric pain persisted and became exacerbated. Six hours later, fetal bradycardia suddenly developed, with a fetal heart rate of 60 bpm, at which time the patient's blood pressure was 127/87 mmHg. The diagnosis was fetal distress complicated with severe preeclampsia. Emergency cesarean section was performed under general anesthesia. The abdomen was opened through a longitudinal incision in the midline below the umbilicus, and a large amount of hemoperitoneum (~1,600 ml) was found. A female baby was born with an Apgar score of 1-2-3 and a weight of 990 g and was transferred to the neonatal intensive care unit. Umbilical artery blood gas analysis showed a pH of <6.80. The area of placental abruption was 70%, and no abnormality was found in the pelvic cavity. Abdominal cavity exploration revealed many blood clots attached to the liver surface. A massive transfusion protocol was initiated, and hepatobiliary surgery consultation was invited. The incision was extended upward to the xiphoid process and the liver was exposed, revealing diffuse subcapsular hematoma and 5-cm ruptures in segments III and VI. Liver hemorrhage decreased after compression by packing gauze pads. During the operation, 8 U red blood cells and 600 ml plasma were infused. The abdomen was closed after placing abdominal and pelvic drainage tubes. After the operation, the patient was transferred to the intensive care unit for close monitoring and supportive treatment, including mechanical ventilation, sedation, continuous blood transfusion, and infection prevention. Laboratory tests showed the following results: Hb 94 g/L, PLT 45 × 10^9/L, ALT 1,017 U/L, AST 1,230 U/L, total bilirubin 99.3 μmol/L, indirect bilirubin 63.0 μmol/L, LDH 765 U/L, activated partial thromboplastin time 44.7 s, and fibrinogen (Fig) 1.5 g/L. The patient was diagnosed with hepatic rupture complicated with HELLP syndrome and received therapeutic plasma exchange (TPE).

The drainage volume on the first day after operation was 2,320 ml. Laboratory tests showed the following results: Hb 83 g/L, PLT 39 × 10^9/L, Fig 1.5 g/L, ALT 1,503 U/L, and AST 1,296 U/L. Thus, her aminotransferase levels were persistently elevated. Computed tomography (CT) showed high and low mixed-density shadows under the liver capsule, and the liver parenchyma was compressed with uneven density (**Figure 1A**). The patient's condition was critical, and a multidisciplinary team (MDT) consisting of critical care medicine, hepatobiliary surgery, interventional therapy, vascular surgery, blood transfusion, infectious diseases, and obstetrics departments made the diagnosis and treatment decisions. MDT discussion concluded that there was persistent hepatic hemorrhage, but the patient's hemodynamics were stable with continuous transfusion. Hepatic artery embolization could be used to control hepatic hemostasis, but there was a risk of hepatic necrosis. After weighing the pros and cons, the decision was to support treatment and close monitoring. The patient developed oliguria and systemic edema with acute kidney injury. Her serum creatinine concentration was normal. She received 4 days of continuous renal replacement therapy.

The drainage volume decreased to 1,225 ml on the second day after the operation. Laboratory tests showed that the patient's Hb (87 g/L) and PLT (43 × 10^9/L) remained stable. Her trans-

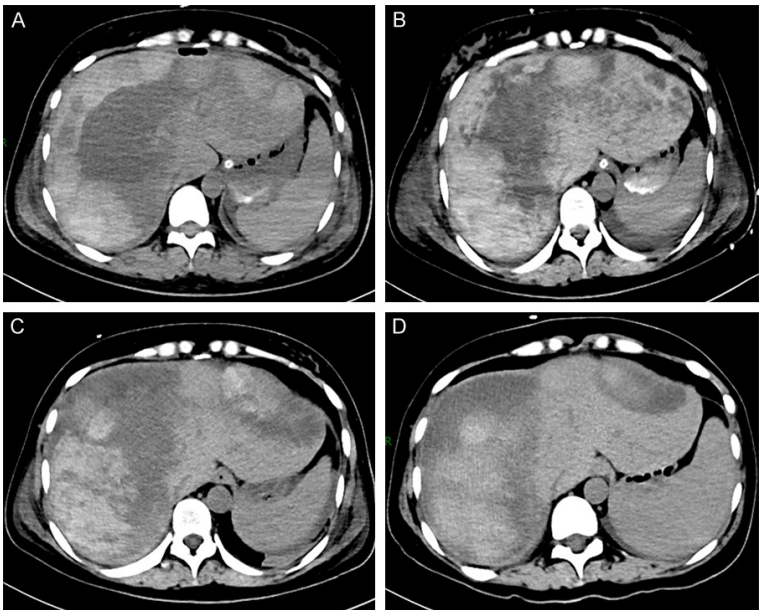

Figure 1. Computed tomography findings of hepatic hematoma. A. Subcapsular hematoma and intrahepatic hematoma on the first day after operation. B. One week after the operation, the hepatic hematoma was stable. C. On the third day of anticoagulant treatment, the hepatic hematoma increased. D. One month after the operation, the hepatic hematoma decreased.

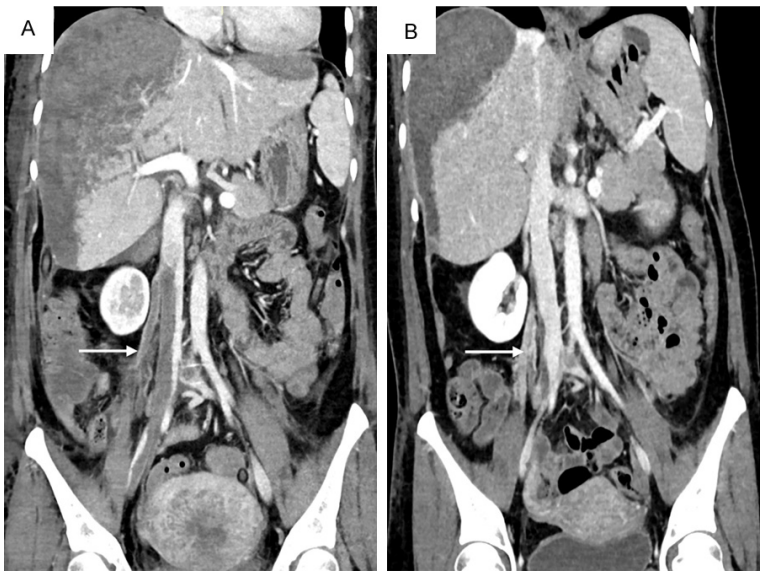

Figure 2. Computed tomography findings of deep vein thrombosis. A. Initial findings of right common iliac vein and inferior vena cava thrombosis 1 week after the operation. B. One month after the operation, the thrombus range decreased after anticoagulant treatment.

aminase levels rose to their highest points (ALT 2,054 U/L and AST 1,913 U/L). Continued daily transfusion was performed to maintain Hb concentration and replenish coagulation factors, and whole blood cell count, coagulation function, and liver function were monitored.

One week after the operation, laboratory tests showed that PLT increased to 55 × 10^9/L and transaminase levels decreased to ALT 400 U/L and AST 80 U/L. CT showed that the hepatic hematoma was stable (**Figure 1B**), but the patient had developed the extremely dangerous complication of inferior vena cava thrombosis. The patient received anticoagulant therapy, and nadroparin calcium 0.6 ml (0.1 ml/10 kg) was injected subcutaneously every 12 h. Subsequent CT venography was used to diagnose thrombosis of the right common iliac vein-external iliac vein and inferior vena cava (**Figure 2A**).

On the third day of initial anticoagulation treatment, the patient's drainage volume increased, Hb decreased from 105 to 85 g/L, and CT showed that the hepatic hematoma was enlarged (**Figure 1C**). A second MDT discussion was conducted immediately, and hepatic rebleeding was considered to be related to anticoagulant treatment. The dosage of nadroparin calcium was halved to 0.6 ml once daily, and blood transfusion continued. As there was a high risk of acute pulmonary embolism, close monitoring was performed. A CT scan after 3 days showed that the thrombus did not progress. Afterward, subcutaneous injection of a half-dose of nadroparin calcium was continued for anticoagulant treatment.

Two weeks after the operation, the drainage fluid was turbid and dark red. Routine examination of ascites showed a positive Li Fanta test and white blood cell count of 372550 × 10^6/L (reference value: 300 × 10^6/L). Laboratory tests showed that the white blood cell count of whole blood was 10.6 × 10^9/L and C-reactive protein (CRP) was 156.2

mg/L. As these findings suggested abdominal infection, a third MDT discussion was conducted. Antibiotics were changed from cefoperazone/sulbactam to imipenem/cilastatin for a 4-day course. CRP decreased to 116.6 mg/L. Ascites culture showed no bacterial growth. The antibiotic was changed again to cefazoxime for a 10-day course. CRP decreased to 80.8 mg/L. Throughout this time, the patient's temperature was normal.

One month after the operation, CT showed decreases in both the hematoma and thrombus (**Figures 1D**, **2B**). The patient was transferred from the intensive care unit to the general ward. The anticoagulant was changed to oral rivaroxaban 20 mg once daily, and the patient was discharged after 2 weeks. In total, the patient was hospitalized for 44 days with transfusions of 34 U red blood cells, 5,400 ml plasma, 34 U cryoprecipitate, and 7 therapeutic volumes of platelets. Unfortunately, the baby died 5 h after birth. At the time of preparation of this report, the patient had been discharged at home for 1 month, and no other complications had appeared.

Discussion and conclusion

In patients with preeclampsia and HELLP syndrome who present with severe right or upper epigastric pain, subcapsular liver hematoma should be highly suspected. Prompt diagnosis is crucial because this can be a life-threatening condition, especially when liver hemorrhage is caused by hematoma rupture [5]. Abdominal ultrasound, CT, or magnetic resonance imaging can be used to accurately diagnose hepatic hematoma and hepatic rupture [2]. However, the symptoms of subcapsular hematoma can be nonspecific, including right or upper epigastric pain, shoulder pain, nausea, vomiting, and bloating, and can be misdiagnosed as acute cholecystitis or pancreatitis [6]. In our patient, preeclampsia was rapidly progressive, and when suggestive symptoms appeared, physicians initially failed to make timely and accurate judgments, thereby delaying the diagnosis of subcapsular liver hematoma. With the continued elevation of blood pressure, a hepatic rupture occurred, which was diagnosed during an emergency cesarean section performed for fetal distress.

Table 1 summarizes the principal treatments and clinical outcomes of reported cases of hepatic rupture complicated with HELLP syndrome, which shows that emergency cesarean section and exploratory laparotomy are the most common treatment methods. A medical team with experience in liver trauma surgery should be invited to consult and initiate a massive transfusion protocol [2]. Surgical treatment of hepatic rupture includes packing, drainage, hepatic artery ligation, and hepatic resection [7-9]. Hepatic rupture complicated with HELLP syndrome is classified as Grade III according to the American Association of Traumatic Surgery liver injury classification, which is a low-grade injury [10], meaning that a gradual approach can be taken to control liver bleeding. In our case, hemoperitoneum was found during an emergency cesarean section, after which surgical exploration and compression by hepatic tamponade were immediately performed and bleeding was controlled. Notably, the case described by Singh et al. involved five operations by laparotomy [11]. To avoid repeated laparotomies for our patient, we removed the tamponade gauze pads and performed intraperitoneal drainage. As patients with hepatic rupture often present with coagulopathy due to potential HELLP syndrome [11], hepatic artery embolization can be used to adjunctively manage patients with persistent liver bleeding or rebleeding after surgical treatment [12, 13]. However, ischemic complications associated with vascular embolization, such as liver necrosis, are not uncommon and may lead to surgical debridement or hepatic resection [14].

TPE is an effective treatment for HELLP syndrome. The indication for TPE in postpartum HELLP syndrome falls into the third category according to the latest guidelines of the American Apheresis Association [15]. In patients with type I HELLP syndrome according to Mississippi classification (PLT $\leq 50 \times 10^9$/L, LDH >600 U/L, and AST/ALT ≥70 U/L), the condition can worsen even when delivery is complete. However, TPE within 24 h after delivery may significantly improve prognosis in such patients [16]. In our case, thrombocytopenia may have also been related to hepatic hemorrhage, but serum bilirubin and lactate dehydrogenase were elevated, indicating that TPE should have been performed as early as possi-

Table 1. Summary of reported cases of hepatic rupture complicated with HELLP syndrome

Reference	Age (years)	Parity	Gestational age (weeks)	Emergency cesarean section	Treatment	Laparotomy (number of times)	Length of stay (days)	Maternal death	Fetal death
Nam IC et al. [6]	35	Primiparous	28	Yes	Surgery and embolization	1	14	No	Yes
Kaltofen T et al. [8]	28	Primiparous	28	Yes	Surgery	1	13	No	No
Singh K et al. [11]	35	Multiparous	34	Yes	Surgery	5	39	No	No
Lam NP et al. [13]	34	Primiparous	32	Yes	Surgery and embolization	2	23	No	No
Cernea D et al. [18]	44	Multiparous	34	No	Surgery	1	16	No	Yes
Marinelli A et al. [19]	27	Primiparous	39	Yes	Surgery	3	6	No	No
Escobar Vidarte MF et al. [20]	NA	Primiparous	30	Yes	Surgery	3	49	No	Yes
	38	Multiparous	26	Yes	Surgery and embolization	4	37	No	Yes
	38	Primiparous	27	Yes	Surgery	2	21	No	Yes
Singh P et al. [21]	16	Primiparous	36	Yes	Surgery and embolization	3	7	No	No
Gutovich JM et al. [22]	41	NA	38	Yes	Embolization	0	9	No	No
Horazeck C et al. [23]	31	Primiparous	40	Yes	Surgery and embolization	2	9	No	No
Mazzola A et al. [24]	39	NA	40	Yes	Surgery and transplantation	2	20	No	Yes

NA = not available.

ble. In addition, the supplementation of coagulation factors by TPE is beneficial for the control of hepatic hemorrhage.

Catheter-related venous thrombosis is a common complication of indwelling central venous catheters. If a patient has confirmed catheter-related venous thrombosis, treatment should be given according to the anticoagulation regimen for deep vein thrombosis [17]. At this point, the risk of thrombus progression should be carefully weighed against the risk of bleeding. In our case, the thrombus was in the inferior vena cava, so the risk of acute pulmonary embolism was high. Also, pulmonary embolism cannot be prevented by the placement of an inferior vena cava filter. Even though our patient was at high risk of bleeding, we still decided to administer anticoagulant therapy. As the patient developed rebleeding after anticoagulant treatment, we finally achieved hemostasis by halving the anticoagulant dose and performing a blood transfusion. A repeat CT scan confirmed that the thrombus had not progressed.

Our case demonstrates that subcapsular hematoma or hepatic rupture should be considered in patients with preeclampsia and HELLP syndrome who suddenly present with right or upper abdominal pain. It is particularly important to perform imaging early to establish the diagnosis. When hepatic rupture occurs, surgery is the treatment of choice. As hepatic rupture is a critical condition in pregnancy and the perinatal period, supportive treatment and management of complications require multidisciplinary management.

Disclosure of conflict of interest

None.

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