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Diagnostic value of computerized tomography (CT) and CT-angiography in diagnosis of cerebral artery embolism after induced Abortion: A Case Report and Literature Review

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► *Case report*

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ABSTRACT

Background: Acute cerebral infarction following induced abortion is a rare but serious complication, often associated with alterations in the coagulation system of pregnant women, hypertension, pregnancy-related vascular disorders, or infections. Considering the societal impact of maternal health issues in reproductive-age women and their effects on families and society, studying the etiology, prevention, and treatment of postpartum stroke is of significant importance. ***Case Summary:*** The patient, a 31-year-old female, was diagnosed with an arachnoid cyst in the posterior fossa of the fetal occipital fontanelle during a prenatal examination, leading to the decision for induced abortion via rivanol amniotic cavity injection. Post-delivery, at four hours and 50 minutes, she presented with acute symptoms of right-sided limb weakness and speech impairment. Emergency cranial CT was performed, revealing extensive infarction within the left cerebral hemisphere. Further diagnostic workup with head CT angiography (CTA) confirmed the presence of a critical occlusion in the left middle cerebral artery, a key finding that directed the subsequent management. Given the contraindications for intravenous thrombolysis during the puerperal period, the patient was promptly transferred for endovascular thrombectomy. The CT imaging was pivotal in establishing the diagnosis and guiding the decision for urgent intervention. Subsequent telephone follow-up indicated a favorable prognosis, highlighting the importance of timely and accurate CT imaging in the management of postpartum stroke. ***Conclusion:*** Postpartum stroke often results from thrombus formation and is associated with significantly high mortality and risk of residual neurological deficits. Therefore, healthcare professionals should be vigilant in observing early symptoms and providing appropriate treatment to prevent symptom progression.

INTRODUCTION

Labor by rivanol intra-amniotic injection is widely used worldwide as a medical means to solve specific pregnancy problems. Although the induction technique is relatively safe, it is also accompanied by non-negligible risks, especially rare but serious complications such as cerebrovascular events [1], especially middle cerebral artery embolism, which may occur after induction of labor. It seriously threatens the life and health of patients [2]. Studies have shown that the risk of stroke increases significantly during the maternal period, especially within the first 6 weeks after delivery, and the incidence can reach 3-8 times that of the general population [3]. During labor induction, hormone levels in women will change significantly, accompanied by certain psychological and physiological stress, and these factors may increase the risk of thrombosis. After induction of labor, endometrial damage, hemorrhage, dehydration and other conditions may lead to increased blood viscosity and further increase the risk of cerebral thrombosis [4]. In addition, postpartum hypertension and cardiovascular insufficiency are also important factors causing cerebrovascular accident [5]. Cerebral infarction after labor induction usually manifests as sudden neurological deficit symptoms, such as unilateral limb weakness, pathesia, language disorder, confusion, etc. Clinically, these symptoms should be alert to occur within a few days after labor induction, and head CT (computerized tomography) or MRI (magnetic resonance imaging) and other imaging examinations should be performed in time for early diagnosis and

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intervention (6). Once diagnosed, comprehensive treatment should be carried out immediately, including thrombolysis, antiplatelet, anticoagulation, lipid-lowering drugs, and rehabilitation training to improve the prognosis. Preventive measures include close monitoring of blood pressure and blood indicators during labor induction, anticoagulant therapy, when necessary, timely treatment of postpartum complications, strengthening health education, improving patients' self-monitoring awareness, and early identification, timely diagnosis and effective treatment, which can improve the prognosis and reduce the occurrence of adverse outcome [7].

This article aims to thoroughly analyze the clinical features, diagnosis, and management of cerebral artery embolism post-induced abortion. It also seeks to identify risk factors and preventive strategies for post-labor cerebral infarction, thereby enhancing medical professionals' understanding and response to neurological complications, optimizing care for pregnant women, and reducing severe complications

This case analyzes a rare patient who experienced left middle cerebral artery embolism after induced labor. According to the present history, past history, course of disease, auxiliary examination, treatment plan and other research, it is of great value to summarize the case and conduct literature analysis of the clinical manifestations, mechanism and prognosis of such postpartum cerebrovascular accidents.

CASE PRESENTATION

Chief complaints

Patient: Female, 31 years old, admitted on August 6, 2022, at 09:43, with the chief complaint of "28 weeks and 2 days of amenorrhea, fetal malformation detected for 20 days".

History of present illness

The patient typically has regular menstrual cycles every 4-6/30 day, with the last menstrual period on January 20, 2022. The pregnancy risk assessment was categorized as yellow (scarred uterus, Body Mass Index (BMI)≥25 kg/m^2). MRI results showed widened posterior fossa cistern in the fetus, with the possibility of a posterior fossa arachnoid cyst and compression of the adjacent cerebellum (as per prenatal examination data)on July 21, 2022. After admission, the patient was informed that the fetal posterior fossa arachnoid cyst could lead to lethal deformities, and observation is possible but carries a risk of poor prognosis for the newborn. After careful consideration by the patient and her family, they requested a medically induced termination of pregnancy. Liver and kidney function tests were normal upon admission, and induced abortion by rivanol amniotic cavity injection was deemed feasible. The patient was informed about the related risks and complications and was given oral misoprostol for cervical ripening.

On August 8, 2022, "induced abortion by rivanol amniotic cavity injection" was performed. On August 10, around 3:00 AM, the patient successfully underwent induced labor at G3P229+6 weeks (to be verified) and delivered a stillborn female fetus. On the morning of August 10, at approximately 7:50 AM, the patient got up to urinate and fell down at the entrance of the bathroom, landing on her buttocks. The nursing staff immediately noticed and, with the assistance of family members, helped the patient back to bed. The patient was conscious but unresponsive when questioned, and she was able to blink, nod, and raise her hand to indicate responses. Oxygen was administered immediately, and continuous electrocardiogram monitoring was initiated. Immediate head CT scan was performed (Model: Bri11iance iCr, China Machinery Injection into 20153300422).

History of past illness

The patient has a history of good health and denies any history of hepatitis, tuberculosis, malaria, or other diseases. She denies a history of hypertension, diabetes, or heart disease. In 2019, she underwent one cesarean section at local hospital. There is no history of trauma or blood transfusion. The patient has no reported medication or food allergies. Vaccination history is unknown. There are no notable findings in the review of systems.

Personal and reproductive history

Patient denies history of smoking or alcohol consumption and any history of promiscuity. She has a history of G3P1, with the birth of a healthy female infant weighing 3.550 Kg via cesarean section in 2019. There were no specific complications during or after the surgery. In 2015, she underwent one induced abortion due to fetal demise at 5+ months of gestation.

Physical examination

The heart rate was 93 beats/min, respiratory rate was 23 beats/min, blood pressure was 119/71 MMHG, right limb muscle weakness, the left pupil was 0.3 cm, the light reflex was slow, the right pupil was about 0.2 cm, the light reflex was slow, the breath sounds in both lungs were thick, no obvious wet rales were heard, the right limb muscle strength was grade 1-2, the left limb muscle strength was grade 3-4. The Babinski sign was positive on the right side, and the pathological sign and meningeal irritation sign were negative on the left side. There was an old transverse scar about 13cm in the lower abdomen.

Laboratory examinations

Emergency laboratory examination revealed mild

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and significant increases in the total number of white blood cells, neutrophils, and monocytes, suggesting the possibility of infection or inflammation. Slightly lower red cell and hemoglobin concentrations may suggest anemia. Low albumin, urea nitrogen, which may be related to the diet to reduce. The remainder of the laboratory tests were normal (table 1).

Table 1. laboratory index.

Emergency blood routine test	
WBC	19.46, 10^9 /L
NE	16.81, 10^9 /L
Lym	1.40, 10^9 /L
Mono	1.09, 10^9 /L
E	0.14, 10^9 /L
B	0.02, 10^9 /L
RBC	4.08, 10^12 /L
HGB	113, g/L
PLT	226, 10^9 /L
Biochemical composition	
TBIL	6.9, umol/L
DB	3.2, umol/L
I-Bil	3.7, umol/L
ALT	25, U/L
AST	36, Un
CysC	0.82, mg/L
LDH	170, Un
TP	60.9, g/L
ALB	30.1, g/L
K	3.91, mmol/L
Na	135, mmol/L
Ca	2.24, mmol/L
Co2	22.2, mmol/L
UBN	1.82, mmol/L
Cr	46, umol/L
UA	350, umol/L

Imaging examinations

Immediate head CT scan (64-slice spiral CT machine (Toshiba 320) Brilliance iCT (20153300422) was performed, which showed no obvious intracranial hemorrhage but a high-density shadow in the left middle cerebral artery. Diagnosis: Large-area infarction in the left cerebral hemisphere (figure 1).

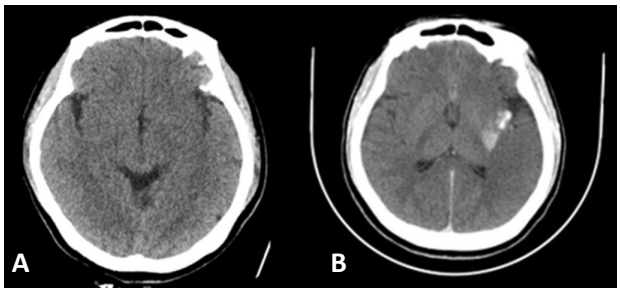


Figure 1. Head CT Scan. **(A)**; Before and **(B)**; after thrombectomy.

Treatment, Outcome and Follow-up

Emergency room into intervention underwent emergency percutaneous internal carotid artery bolt extraction for + intracranial artery bolt extraction for + carotid stenting + cerebral angiography of the left internal carotid artery, the aorta angiography, postoperative ICU for dehydration of intracraninal pressure, improve cerebral perfusion after comprehensive treatment effect is not ideal, such as brain edema is aggravating, reexamine the skull CT prompt ectocyst area on the left of the insula cerebral hemorrhage, The left frontotemporal parietal decompressive craniectomy and artificial meningeal repair were performed in emergency. ICU was used to support respiration, dehydration to reduce intracranial pressure, improve cerebral perfusion, anti-infection, maintain the stability of internal environment, and symptomatic treatment. Improved after treatment, recovery of consciousness, improve breathing, stop breathing machine remoal of endotracheal intubation. Into the neurology to continue treatment. To give the patients after dehydration, anti-infection, nutritional support, anticoagulation, allergies and other symptomatic treatment; To rehabilitation therapy, exercise, etc.

Postoperative brain CT showed: 1, the left frontal and temporal parietal bone flap of shadow, to the top of the left frontal and temporal epidural hemorrhage, top of the left frontal scalp soft tissue swelling, change is not obvious; 2, left cerebral hemisphere encephalomalacia, left cerebral peduncle - posterior limb of the internal capsule area slightly low-density shadow, similar to the former. According to figure 1, it can be found that the patient's CT improved significantly after thrombectomy. The patients with conscious, vomit word owe clearly, improve the right limbs hemiplegia, can walk, get better, through communication with the patient and family condition after its voluntary choice hospital discharge, details about related matters needing attention after discharge, to go through the discharge. Postoperative telephone follow-up showed that the patient was treated with thrombectomy in time and recovered well. Half a year after the operation, the left cerebral artery was found to be patent when DSA was reexamined in January 2023 in our hospital, and the patient recovered well (figure 2).

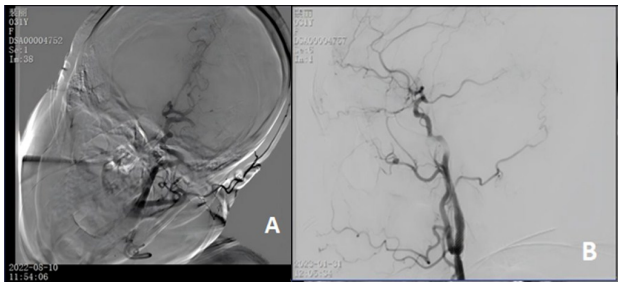


Figure 2. Intraoperative **(A)** and postoperative **(B)** DSA images of thrombectomy.

DISCUSSION

Physiological changes during pregnancy increase the risk for stroke, especially in women with preexisting cardiovascular injury or risk factors [12].

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Among nonpregnant women aged 15 to 49 years, the incidence of stroke is 21 cases per 100,000 women, whereas the incidence of pregnancy-related stroke is approximately 34 cases per 100,000 live births [13]. The incidence of pregnancy-related stroke has been on the rise, reflecting the increasing prevalence of obesity, heart disease, and hypertension among women of reproductive age [14].

Pregnancy-related cerebrovascular events are often caused by thrombosis and are associated with significant mortality and a high risk of residual neurologic deficits [15]. Therefore, evaluation for cerebrovascular events is necessary in cases of pregnancy-related stroke.A review of the literature suggests that a previous history of hypertension and a patent foramen ovale (PFO) may contribute to the development of ischemic stroke in patients with deep venous thrombosis of the lower extremity but no stroke etiology has been identified. Paradoxical embolism refers to venous or right heart thrombus entering the arterial or systemic circulation. Hypercoagulable state of pregnancy is also prone to venous thrombosis, and venous thromboembolism is a common and potentially serious complication of late pregnancy and postoperative delivery. The propensity for thrombosis is a predisposing factor for thrombosis [16]. The resulting lack of brain cell function results in motor and sensory symptoms such as headache, weakness, partial paralysis, language difficulties, confusion, and loss of consciousness. If proper blood flow to and from the brain is rapidly restored, the cells can regain function. Prolonged interruption of blood flow can lead to cell death, and the loss of brain cells, due to their lack of regenerative capacity, can lead to long-term motor and cognitive impairment and even fatal disease [17].

Research indicates that [18]MRI and magnetic resonance venography are considered the best methods for diagnosis and follow-up, while transesophageal echocardiography and ultrasound imaging are useful techniques for diagnosing patent foramen ovale (PFO).The Royal College of Obstetricians and Gynaecologists in the UK categorizes women into low, moderate, and high-risk groups and recommends thromboprophylaxis for moderate-to-high-risk women [19]. Recommended treatment options for preventing recurrent arterial embolism include observation, antiplatelet therapy, systemic anticoagulation, and percutaneous or open surgical closure of PFO.

Our case report presents a patient who experienced a left middle cerebral artery embolism following induced abortion, leading to acute cerebral infarction. Such occurrences are relatively rare but are increasingly recognized in the perinatal period. According to Wang *et al*.[20], pregnancy-related stroke typically occurs during pregnancy and up to 6 weeks postpartum, with some thrombotic events extending to 12 weeks postpartum. Their study revealed that among 37,360,772 pregnancy-related hospitalizations, approximately 16,694 (0.045%) involved acute strokes, with in-hospital mortality rates nearly 385 times higher for patients with acute stroke/TIA compared to those without stroke. In our case, the patient developed acute symptoms of right-sided limb weakness and speech impairment just four hours and 50 minutes after delivery, aligning with the literature's emphasis on the hypercoagulable state during pregnancy and its thrombotic complications. Bodur *et al*. [21] highlight the increased risk of embolic events in the postpartum period for patients with a patent foramen ovale (PFO), especially when accompanied by deep vein thrombosis. Our case also suggests that the physiological changes post -induction may precipitate cerebrovascular events. Furthermore, the literature points out that hypertension during pregnancy, HELLP syndrome, and other pregnancy complications can increase the risk of stroke. Although our patient had no significant history of hypertension, the physiological and psychological stress of the induction process may have contributed to increased blood viscosity and thrombus formation, consistent with the hypercoagulable state described in the literature for the perinatal period.

In terms of emergency care and treatment, the literature emphasizes the importance of rapid diagnosis, especially in the context of stroke during pregnancy and the postpartum period. In our case, the patient underwent an emergency cranial CT scan, which promptly identified the critical occlusion in the left middle cerebral artery, leading to an expedited endovascular thrombectomy. This timely imaging and intervention are supported by the literature as crucial in the management of pregnancy-related stroke.

CONCLUSION

In conclusion, the analysis of our case aligns with existing literature, underscoring the complexity and potential high-risk factors associated with pregnancy-related cerebrovascular events. Future research should continue to explore the mechanisms, risk assessment, and early intervention strategies for pregnancy-related stroke to improve maternal and fetal outcomes.

Availability of Data and Materials: The data involved in the present study can be provided under reasonable request.

Author Contributions: All authors contributed to the study conception and design. Material preparation, data collection was performed by XJT and QLL. The first draft of the manuscript was written by XJT, TL and ZH. QLL commented on previous versions of the manuscript. All authors read and approved the final manuscript.

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Ethics Approval and Consent to Participate: This study protocol was reviewed and approved by the Ethics Committee of Neijiang Maternal and Child Health Hospital in accordance with regulatory and ethical guidelines. Informed consent was waived for this study due to the exclusive use of de-identified patient data, which posed no potential harm or impact on patient care.

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Conflict of Interest: The authors declare that they have no conflict of interest.

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