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Ultrasound Identification of Right Internal Jugular Vein Occlusion After Catheterization in a Premature Infant

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Statistical Analysis C
Data Interpretation D
Manuscript Preparation E
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Conflict of interest: None declared

Patient: Male, infant
Final Diagnosis: Right internal jugular vein occlusion
Symptoms: No obvious symptoms
Clinical Procedure: —
Specialty: Anatomy • Anesthesiology

Objective: Unusual clinical course

Background: Right internal jugular vein (RIJV) catheterization is a routine clinical procedure for gastrointestinal surgery. The conventional blind puncture method is often unable to detect vascular anatomical variations, particularly in premature infants. Through widespread adoption of ultrasound-guided puncture techniques, the success rate of catheterization has substantially increased, and vascular anatomical abnormalities can be promptly identified. Internal jugular vein occlusion after catheterization is rarely reported in premature infants. This case report describes RIJV occlusion in a premature infant after 43 days of catheterization without preceding warning signs.

Case Report: A premature infant underwent surgery for intestinal obstruction on June 28, 2024. A catheter was inserted into the RIJV and kept in place for 43 days. During catheterization, the catheter was managed according to standard nursing procedures. On October 22, 2024, central venous catheterization was required again. Ultrasound examination showed complete occlusion of the RIJV. Catheterization was successfully performed in the left internal jugular vein under ultrasound guidance as an alternative approach.

Conclusions: Several risk factors contribute to catheter-related thrombosis in premature infants undergoing central venous catheterization. Meticulous care measures should be implemented to maintain vessel patency after internal jugular vein catheterization. Early detection of thrombosis and occlusion is essential in infants. As a noninvasive and convenient assessment tool, ultrasound should be used to detect anatomical abnormalities and minimize vascular injury, particularly in infants with a history of catheterization.

Keywords: Infant, Premature, Diseases • Catheterization, Central Venous • Ultrasound, High-Intensity Focused, Transrectal • Anesthesiology • Jugular Veins • Vascular Occlusion • Case Reports

Full-text PDF: https://www.amjcaserep.com/abstract/index/idArt/952818

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Introduction

Infant internal jugular vein (IJV) catheterization is an invasive vascular procedure that provides long-term venous access. It can be performed in infants undergoing gastrointestinal surgery that requires prolonged postoperative fasting, as well as in infants who require fluid resuscitation, blood transfusion, meticulous hemodynamic monitoring, blood purification therapy, and other intensive treatments [1]. Premature infants are susceptible to catheter-associated infections, venous thrombosis, and catheter occlusion due to vascular fragility and poorly defined anatomical landmarks. Vascular occlusion after IJV catheterization is commonly observed in adults but is rarely reported in low-birth-weight infants. In the present case, a low-birth-weight premature neonate underwent ultrasound-guided right internal jugular vein (RIJV) catheterization during the initial surgery. Ultrasound imaging later demonstrated RIJV occlusion during a second surgery requiring central venous catheter (CVC) placement. Therefore, this procedure should be performed by experienced medical personnel under ultrasound guidance to maximize success rates and minimize potential complications.

Case Report

A male infant was born on May 10, 2024, at 30+4 weeks of gestation with a birth weight of 1800 g. He was admitted to the neonatal intensive care unit and underwent ultrasound-guided RIJV catheterization on June 28, 2024, due to ileostomy surgery. The RIJV appeared normal in shape, and initial catheterization was successfully performed. The CVC was removed after 43 days of catheterization. During the catheterization period, the infant showed no signs of local infection or phlebitis, and no symptoms of venous thrombosis were observed. Unfortunately, a second RIJV catheterization was required after ileostomy reversal surgery on October 22, 2024. Ultrasound imaging failed to visualize the RIJV due to complete occlusion. Consequently, the left internal jugular vein (LIJV) was successfully cannulated under ultrasound guidance (**Figure 1**). The same catheter type was used for both procedures (Arrow, 4-Fr). Postoperatively, intravenous fluids were administered through the LIJV catheter (**Figure 2**). Nursing staff disinfected the skin surrounding the catheter every 2 days, performed saline pulse flushing before and after infusion, and locked the catheter with heparinized saline after daily infusions. With meticulous catheter

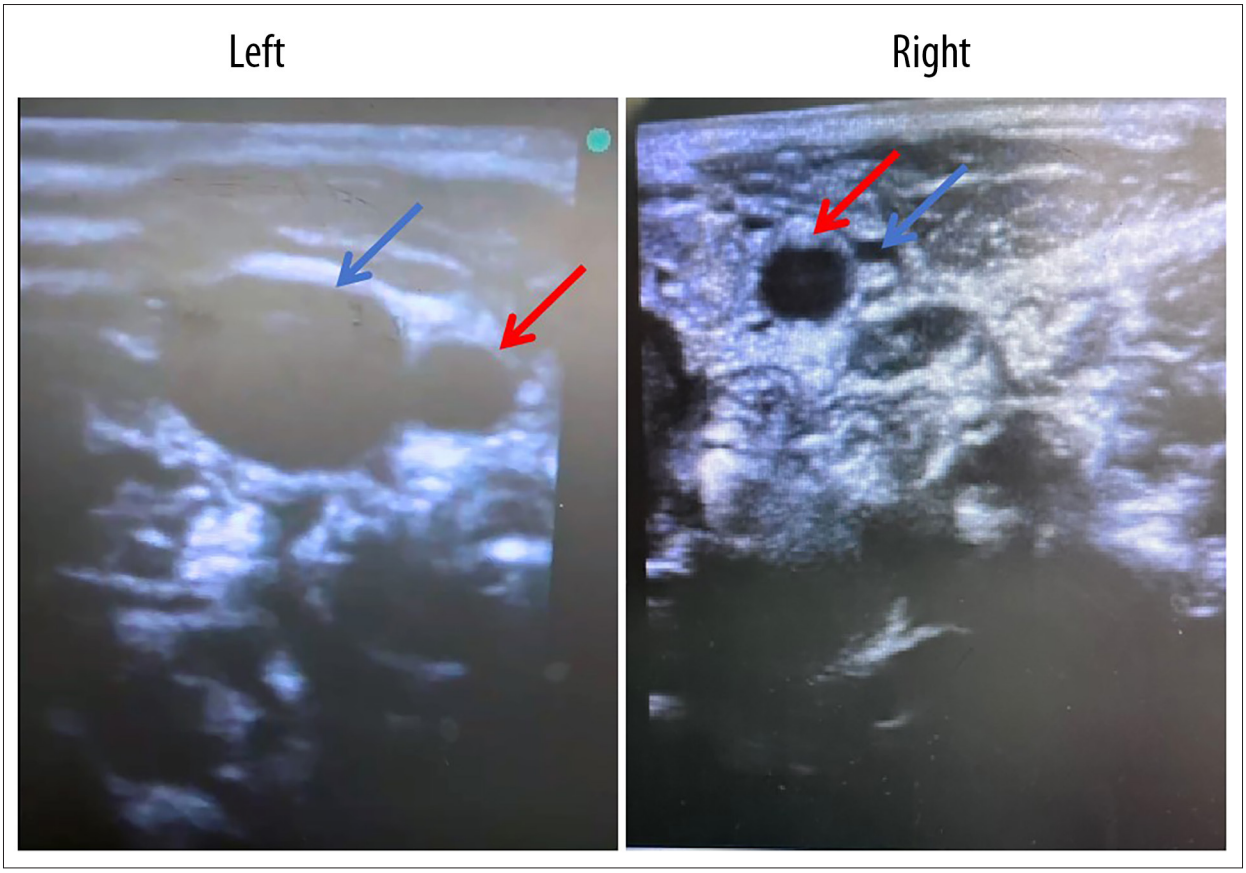

Figure 1. (**Left, Right**) Bilateral cervical vascular ultrasound images. The left internal jugular vein is normal in appearance, whereas the right internal jugular vein is nearly occluded. The red arrow indicates the internal carotid artery, and the blue arrow indicates the internal jugular vein.

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Figure 2. Image of the infant undergoing catheterization of the left internal jugular vein. Catheterization was performed under ultrasound guidance before the second surgery, as indicated by the white arrow.

Figure 3. Chest radiograph obtained after the second catheterization. The image shows the catheter positioned in the left internal jugular vein; the catheter tip is located at the level of the second thoracic vertebra, as indicated by the white arrow.

care, the catheter remained patent. Ten days later, the catheter was removed. Ultrasound examination performed 2 months after surgery showed that the RIJV remained unvisualizable, whereas the LIJV demonstrated no change in vascular diameter compared with the initial catheter placement. Throughout the catheter indwelling period, coagulation function tests and blood examinations showed no evidence of a hypercoagulable state. Postoperative radiography demonstrated that the distal tip of the LIJV catheter was located at the level of the second thoracic vertebra (**Figure 3**), which is important for confirming appropriate catheter placement [2].

Discussion

Occlusion after central venous catheterization is a recognized complication of CVC placement. In the present case, a low-birth-weight premature infant received continuous infusion through an RIJV catheter. The catheter remained patent during routine nursing care, and the infant exhibited no clinical symptoms of thrombosis. However, ultrasound examination performed approximately 4 months later revealed silent RIJV occlusion. Such asymptomatic vascular occlusions are often overlooked without ultrasound evaluation and thus warrant greater clinical attention.

Catheter-related thrombosis (CRT) in infants is commonly identified by physicians or caregivers. Vascular ultrasound may serve as a useful adjunctive diagnostic tool. The clinical presentation of CRT considerably varies, ranging from complete absence of symptoms to specific local or systemic manifestations. In neonates, particularly preterm infants, symptoms are often atypical or mild; thrombosis is frequently detected incidentally during routine ultrasound screening or imaging studies performed for other reasons [3]. Common clinical findings include signs of venous flow obstruction, elevated D-dimer levels, and dynamic changes in platelet counts. However, blood test specificity is often limited.

Vascular ultrasound is the preferred method for diagnosing CRT because it is noninvasive, radiation-free, and portable. It also allows visualization of the thrombus location and its relationship to the vessel wall, assessment of thrombus size, and calculation of the thrombus-to-vessel ratio in infants. Computed tomography angiography is rarely used in infants due to radiation exposure and procedural complexity. Chest radiography is commonly utilized to confirm the position of the CVC tip. Central venous pressure monitoring is a simple assessment tool that can aid in early detection of catheter obstruction [4], although further studies are needed to establish threshold alarm values.

Some neonates have a high risk of thrombosis. Low birth weight and young gestational age can disrupt the physiological balance between coagulation and fibrinolysis in newborns, thereby increasing thrombosis risk. Although thinner catheters can reduce the risk of catheter-related thrombosis, increased puncture difficulty may increase the likelihood of vascular endothelial injury, a key factor in thrombus formation. Additionally,

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catheter indwelling time longer than 6 days, a catheter-to-vessel diameter ratio greater than 0.33 [5], and catheter dysfunction are independent risk factors for CRT. Analgesic or sedative medications can also increase the risk of thrombosis [6]. D-dimer is a biomarker of coagulation and fibrinolysis, and elevated D-dimer levels represent an independent risk factor for thrombosis [7]. D-dimer level monitoring and implementation of targeted preventive measures at an early stage are important for thrombosis prevention. When clinically indicated, primary anticoagulation therapy and ultrasound monitoring should be considered [8].

Catheter insertion and friction between the catheter and the vessel wall may result in endothelial injury, thus increasing thrombosis risk. Accordingly, monitoring for a hypercoagulable state is essential. The use of heparinized saline flushing in neonates remains controversial. The observed incidence of catheter occlusion in neonates is approximately 65%. Even with regular heparin flushing, the incidence of asymptomatic CRT after catheter removal can reach 72% [9]. Most thrombi involve less than 40% of the vessel diameter and may resolve spontaneously. However, when the thrombus initially occupies more than 58% of the vascular diameter, progression to complete occlusion or stenosis is more likely. In such cases, regular follow-up and anticoagulant therapy can be considered [9]. Previous studies have shown that routine catheter flushing using a heparin-free maintenance protocol is safe and effective [10,11], thereby reducing the risk of heparin-associated bleeding and heparin-induced thrombocytopenia in premature neonates, which is particularly important in this population.

The association between catheterization site and the incidence or prognosis of CRT remains unclear [12]. Accidental puncture of the subclavian artery can hinder compression hemostasis, whereas femoral vein catheterization carries a risk of urine contamination. Therefore, repeat catheterization was performed under ultrasound guidance via the LIJV. The infant's weight increased over time, resulting in a larger vascular diameter and a lower catheter-to-vessel ratio. Additionally, postoperative care was improved, and the indwelling duration of the second catheterization was shorter. Increased neck mobility in infants can increase susceptibility to endothelial injury, thrombosis, and subsequent venous occlusion. Furthermore, multiple surgical procedures and postoperative inflammation may have further increased the risk of thrombosis or mechanical obstruction. These factors might explain the occurrence of RIJV occlusion after the first catheterization but not after the second.

In summary, CRT is not uncommon in neonates with CVCs. Thus, careful monitoring for thrombosis after catheterization is essential. Even in the absence of symptoms, regular ultrasound follow-up in high-risk infants is safe and feasible, particularly concerning those with a history of venous obstruction who may require future vascular interventions.

Conclusions

RIJV occlusion after catheterization in low-birth-weight infants is a serious complication with important implications for future vascular access. The present case highlights the high risk of CRT, the importance of early complication detection using ultrasonography, and the need for meticulous catheter care in this vulnerable population. As neonatal care advances, greater emphasis on catheter safety and monitoring is essential to reduce the incidence of such complications.

Patient Consent

The authors obtained informed consent from the patient's guardian. The study was also approved by the Ethics Committee of Huai'an Maternal and Child Health Care Center.

Declaration of Figures' Authenticity

All figures submitted have been created by the authors who confirm that the images are original with no duplication and have not been previously published in whole or in part.

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