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Case Report

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Hepatic Lesions of Total Parenteral Nutrition Secondary to Umbilical Venous Catheter (UVC) Malpositioning in a Very-Low-Birth-Weight Infant

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Abstract

Background: Umbilical vein catheterization (UVC) is a common operation to achieve vascular access in preterm infants. However, there are complications associated with their use. One uncommon complication is hepatic collection due to the inadvertent extravasation of parenteral nutrition fluids caused by umbilical venous catheter (UVC) malpositioning in the portal venous system.

Objective: The purpose of this report is to remind clinicians that when a UVC is mispositioned, they should actively screen for potential complications or stop using the catheter as soon as possible to avoid the occurrence of serious complications.

Methods and Results: We present a case of fluid extravasation due to catheter misplacement causing hepatic collection of total parenteral nutrition (TPN) in a very-low-birth-weight (VLBW) preterm infant.

Conclusions: Under special conditions, when a UVC is in a suboptimal position, abdominal radiographs should be reviewed regularly to detect displacement of the tip catheter early. In such cases, the catheter should be removed as soon as possible to reduce the duration of use. The position of a UVC should be carefully monitored by regular X-ray or bedside ultrasound examinations.

Background

Umbilical Vein Catheterization (UVC) is a common procedure performed in the Neonatal Intensive Care Unit (NICU) **[1].** UVCs allow quick access for the administration of intravenous fluids and drugs, as well as blood products and parenteral nutrition, to acutely ill neonates; aside from these benefits, there are complications associated with their use **[2-4].** One uncommon complication is fluid extravasation due to catheter misplacement. Inapposite UVC positioning can sometimes cause such leakage into the liver, causing significant damage to the liver parenchyma or leading to necrosis of the area **[3,5].** We present the case of a preterm baby who developed partial necrosis of the liver following UVC malpositioning and successfully recovered following discontinuation of the catheter and abdominal paracentesis of the fluid.

Case Presentation

This female neonate weighing 1.42 kg was born at 36 1/7 weeks of gestation by vaginal delivery 8 hours after membrane rupture. There was no history of maternal hypertension or diabetes. The mother underwent regular prenatal examinations during pregnancy and was negative on Group B Streptococcus (GBS) screening. After birth, the Apgar score was good. However, the baby had poor respiratory efforts at one hour after birth, requiring Bilevel Positive Airway Pressure (BiPAP). For vascular access, a 3.5-Fr double-lumen UVC was inserted uneventfully. The tip of the catheter was placed to the right of the vertebral column, at the level of the T10 vertebra, below the level of the diaphragm **(Figure 1A).** The UVC was used for all infusions, including TPN.

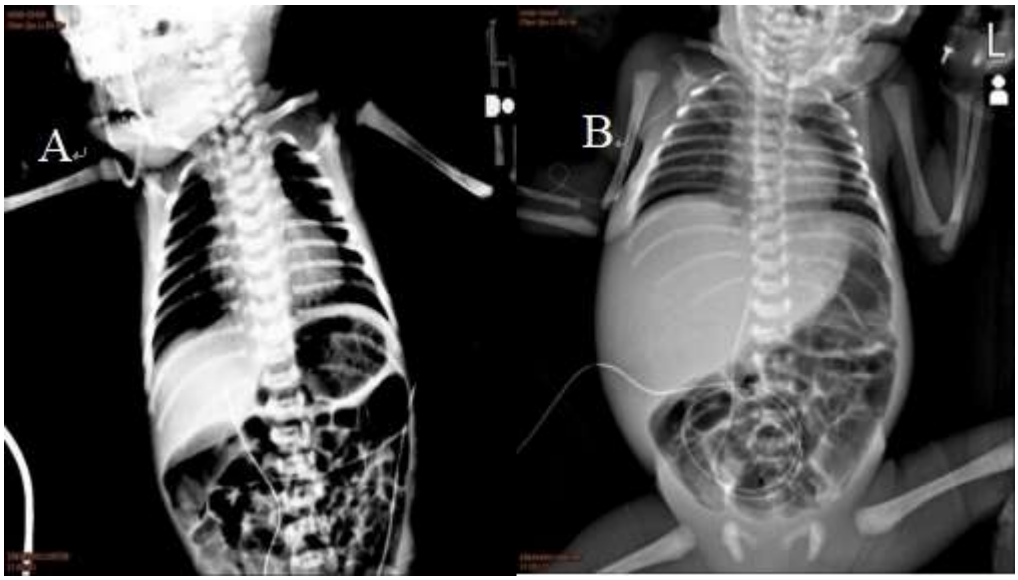

Figure 1: A) Abdominal X-ray showing the tip of the catheter to the right of the vertebral column at the level of the T_{10} vertebra. B) Abdominal X-ray of the patient on the 6th day of umbilical venous catheter placement. The tip of the catheter is at the level of the T12 vertebra.

On day 3 of life, the patient showed signs of sepsis with temperature instability, dyspnoea, circulatory system instability and increased serum inflammatory parameters (CRP, 22.8 mg/l; reference range <8 mg/L). We started treatment with antibiotics. On day 7 of life, abdominal distension developed. Radiography revealed a gasless abdomen **(Figure 1B),** and abdominal ultrasonography revealed a significant amount of free fluid but no pathology in the liver. However, abdominal radiography showed that the tip of the UVC was midline, at the level of the L1 vertebra, below the level of the diaphragm. Ultrasound (US) examination of the abdomen showed no abnormalities in the liver. There was no evidence of any perforation or Necrotising Enterocolitis (NEC). On day 9 of life, the signs of sepsis did not improve, and the laboratory tests showed an elevated CRP level (69.9 mg/L), thrombocytopenia, abnormal liver enzyme levels (ALT, 199 U/L; reference range <40 U/L) and coagulation disorders. CT revealed a 5.3 cm, complex, air-containing fluid collection in the liver **(Figure 2).** Ultrasound (US) examination of the abdomen showed a fluid collection in the liver **(Figure 3A)**. The UVC was removed, and a Peripherally Inserted Central Catheter (PICC) was placed. She received normal saline boluses, fresh-frozen plasma and other blood products during this period. In view of the critically ill state of the infant, the surgeons performed US-guided hepatic collection aspiration by inserting a Penrose drain to relieve the abdominal pressure. Approximately 60 ml of milky-looking fluid was drained. Fluid analysis indicated

triglycerides consistent with TPN. However, the glucose concentration was 2%. Following paracentesis, the baby's condition improved significantly.

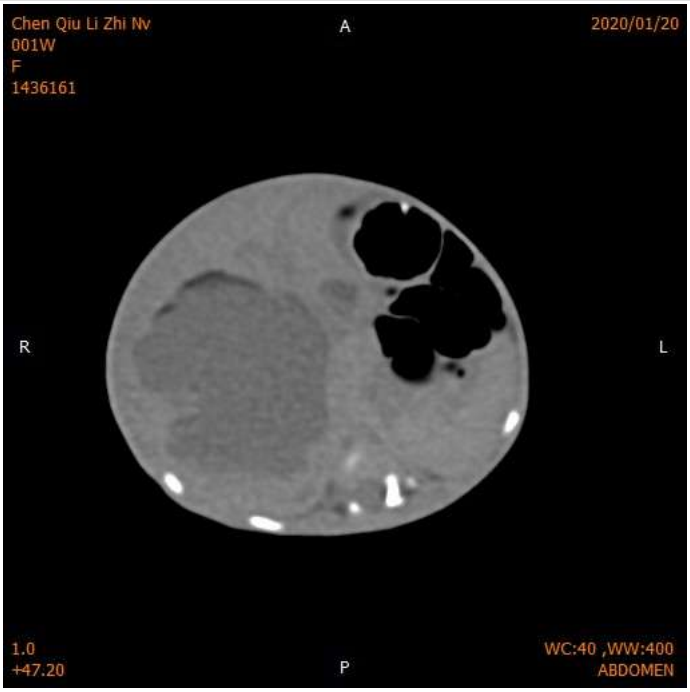

Figure 2: CT demonstrating a large, 5.3 cm, complex, air-containing fluid collection in the liver (see arrows).

On day 9 of life, the liver showed a solid-cystic echogenic lesion measuring 3.6×2.8 cm with a visible internal separation. The surgeons performed US-guided hepatic collection aspiration without fluid withdrawal and recommended conservative treatment. Eleven days later, the patient developed fever again. Subsequently, repeat US examination showed that the lesion had not been absorbed and measured 3.0×2.3 cm, with no vascularity **(Figure 3B).** The surgeons again performed US-guided hepatic collection aspiration. Repeat follow-up US examination 2 weeks later demonstrated the lesion to have decreased to 2.5×0.9 cm, with a hyperechoic lesion (likely from calcium in the lesion). On day 27 of life, the baby was cured and discharged. A CT scan performed on day 44 of life (17 days after discharge) for follow-up examination of these lesions revealed a 1.3-cm, punctate, low-density shadow in the left lobe of the liver. At 7 months of age, follow-up US revealed dystrophic calcifications in areas previously identified as abnormal fluid collections in the liver **(Figure 3C).**

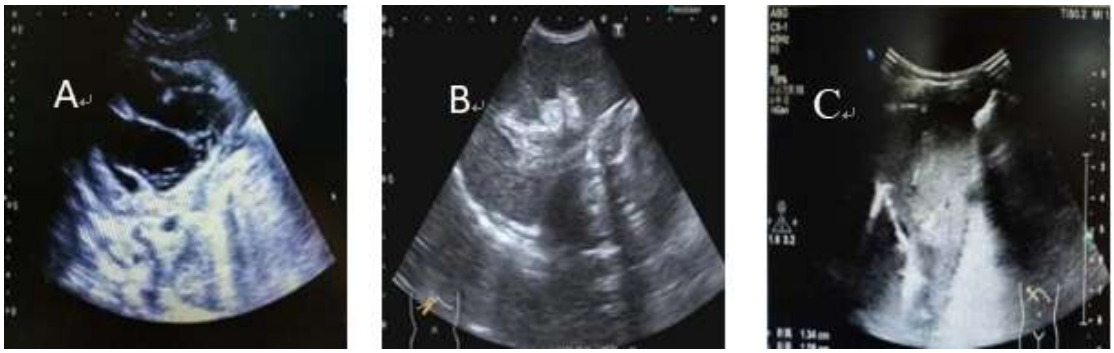

Figure 3: A) US-guided drainage of a hepatic collection in a 36-week-old, 1.42-kg infant. a: US on day 9 of life demonstrating a large, heterogeneous fluid complex collection measuring 5.7×4.0 cm in the liver. B) Repeat US examination showing that the lesion had not been absorbed and measured 3.0×2.3 cm, with no vascularity. C) Follow-up US 6 months after US-guided aspiration of the hepatic collection showing a resolving lesion with residual dystrophic calcifications.

Discussion

In this case, a UVC was improperly placed during a prolonged period of parenteral nutrition infusion, and the findings demonstrate that the entry of hypertonic fluid into the liver may lead to parenchymal injury or parenchymal necrosis. This is consistent with previous reports **[4,5].** UVC placement is a commonly used procedure in the NICU. However, great care must be taken to ensure proper placement to prevent possible short-term and long-term complications. The tip of the umbilical catheter must be placed over the diaphragm at the junction of the inferior vena cava and right atrium corresponding to T9 **[5,6].** In our case, the UVC was in a suboptimal position (T_{10-11}), and the tip was superimposed over the liver. In view of the difficulty of venous access, we accepted the suboptimal position. Since UVCs are placed by estimating (shoulder-umbilical length) rather than confirming the placement in real time, a UVC may inadvertently enter the portal vein system during placement. In addition, it is possible to transfer the tip of the venous catheter into the portal vein, even at the appropriate initial location. Hence, it is important to emphasize that UVC placement in the inferior vena cava is necessary, although the ideal location is the confluence of the inferior vena cava and right atrium. Confirmation of the location of the UVC tip is usually done by radiography. However, a recent study has shown that X-rays often cannot accurately show the location of a UVC in premature infants and that real-time US or echocardiography is a more accurate technique to determine the appropriate location of the UVC tip [7].

Although a UVC should be removed as soon as possible, it can be retained for up to 14 days if the catheter placement is appropriate **[8].**

Our case demonstrates the efficacy of this method and of US-guided drainage, as well as the necessity of multidisciplinary treatment in acute and severe cases. The prognosis in this case was good. Although the use of UVCs is part of daily management in the NICU, it is important to be aware of their potential complications and to monitor their location by radiography or US. Catheter-related complications must be considered whenever there is acute abdominal distension with a UVC in place.

Conclusion

Malpositioning of the UVC was the most likely cause of hepatic collection/necrosis. Under special conditions, when a UVC is in a suboptimal position, abdominal radiographs should be reviewed regularly to detect displacement of the tip catheter early. In such cases, the catheter should be removed as soon as possible to reduce the duration of use. The position of a UVC should be carefully monitored by regular X-ray or bedside ultrasound examinations.

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