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Case Report

Non-perforated cardiac tamponade associated with a central venous catheter in a premature infant with extremely low birth weight

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ABSTRACT

Central venous catheterization is almost routinely used in neonatal intensive care, especially in premature and extremely low-birth-weight infants. One of the rare but life-threatening complications is pericardial effusion and cardiac tamponade. In addition to perforation, tamponade may develop with osmotic damage of the fluid administered. This article presents a case of cardiac tamponade due to central venous catheterization in an extremely low birth weight newborn.

Keywords: Cardiac tamponade, central venous catheter, premature, pericardiocentesis

INTRODUCTION

Central venous catheters are used to provide safe access to intravenous fluid and antibiotic therapy, total parenteral nutrition, and blood collection in low birth weight and sick newborns. They are often placed as the first step in the management of infants hospitalized in the neonatal intensive care unit. During and after central catheter placement, several complications have been observed, including catheter fracture, migration, and dislodgement that may result in occlusion, catheter-related infection, thrombosis, and also vessel wall perforation.[1,2]

Pericardial effusion following umbilical venous catheterization is a rare complication.[1] It may occur with the perforation of the atrial wall by the catheter or by osmotic effect without mechanical damage.[2,3] Cardiac tamponade is a life-threatening condition associated with massive pericardial effusion that can cause hemodynamic instability, low cardiac output, severe hypotension, and mortality in the newborn. Early diagnosis and pericardiocentesis are lifesaving.[3]

We aimed to present the management of central venous catheter-associated cardiac tamponade in a premature infant.

CASE

A 750 g female baby born from a 36-year-old healthy mother at 28+4 weeks of gestation by cesarean section was admitted to the neonatal intensive care unit for respiratory distress. After she had been intubated, respiratory distress syndrome developed, and then she was operated for necrotizing enterocolitis.

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A 28-gauge peripheral central venous catheter (PICC) was placed through the left basilic vein on postnatal day 19. After placement, the position of the catheter was confirmed by chest radiography, and the catheter tip was found at the junction of the superior vena cava and right atrium. Circulatory disturbance and hypotension (36/12/22 mmHg) developed on postnatal day 23, 4 days after catheter placement. Dopamine infusion was started at a dose of 5 mcg/kg/min. Ventilator parameters (frequency and FiO_2) were increased to maintain oxygen saturation above 92%. When echocardiography was performed on the patient, who was found to have cardiomegaly on chest radiography, subcostal examination revealed 10 mm of fluid accumulation in the pericardial space and collapse of the right ventricle in diastole and the right atrium in systole was observed (Figure 1, 2).

The patient was evaluated as cardiac tamponade and 25 ml of clear fluid was drained during pericardiocentesis with echocardiography. 2-3 leukocytes/mm^3 and rare erythrocytes were observed in the fluid cell count. There was no microbiological growth in the fluid sample taken. The pericardial fluid was biochemically similar to the total parenteral nutrition she was receiving (glucose 708 mg/dl, LDH 17 U/L, albumin 0.1 g/dl).

Figure 1. Chest x-ray showing increase of the cardiac area

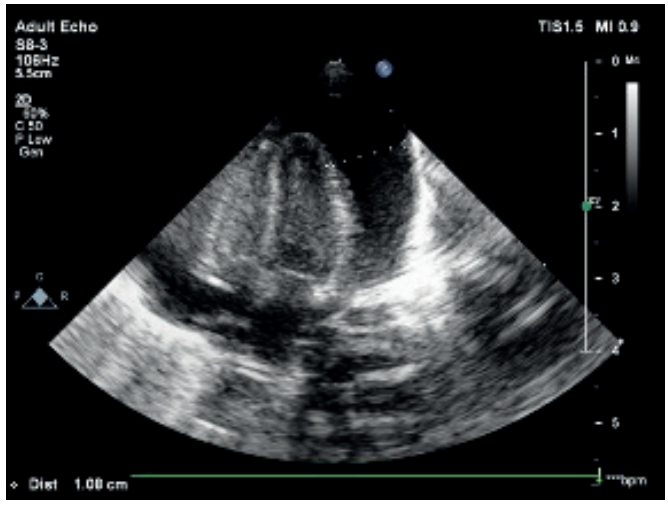

Figure 2. Four chamber echocardiography view showing a significant pericardial effusion

Figure 3. Chest X-ray after pericardiocentesis

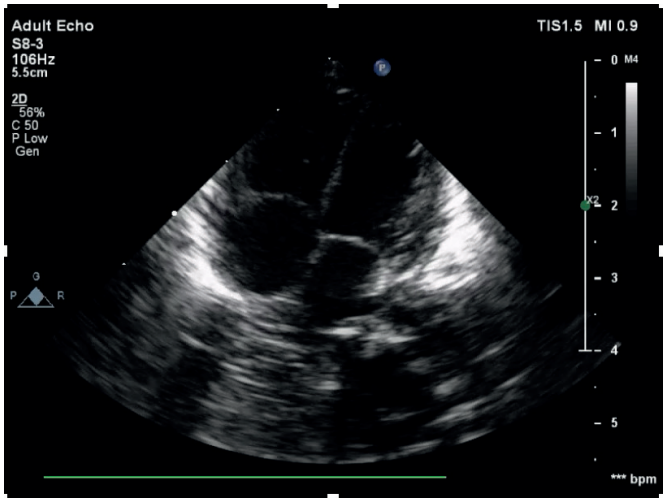

Figure 4. Four chamber echocardiography view after pericardiocentesis

After pericardiocentesis, the catheter was withdrawn 1 cm. Saline contrast echocardiography was performed and the catheter was left in place to be used when no transition between the pericardial leaves was observed. The catheter tip was checked with a chest radiograph (Figure 3). No pericardial effusion was observed on follow-up echocardiography (Figure 4).

DISCUSSION

Central venous catheters are widely used in neonatal intensive care units to provide total parenteral nutrition, especially in premature newborns.[4] In addition to the convenience it provides, it may lead to complications such as catheter-related infection, cardiac arrhythmia, intracardiac thrombosis, embolism, endocarditis, myocardial perforation, pleural effusion, and pericardial effusion.[5]

Pericardial effusion and cardiac tamponade, which are life-threatening complications, occur with catheter misplacement or dislodgement and are frequently observed on the 3rd day after insertion.[6] To prevent this, the recommended position for the catheter tip is at the junction of the inferior vena cava and the right atrium. The position of the catheter tip is determined by radiography both during insertion and at follow-up.[3] The 2001 Manchester Report recommended that all central venous catheters placed in newborns, especially for total parenteral nutrition, should be left outside the borders of the heart on chest radiography.[7] In addition, when autopsy reports were examined, it was thought that hyperosmolar fluid may cause osmotic damage to the endothelium and lead to effusion formation without mechanical damage to the catheter. The presence of non-hemorrhagic pericardial fluid samples with biochemical characteristics similar to TPN supports this hypothesis.[6]

In our case, cardiac tamponade developed on the 4th day after catheter placement. The catheter tip was seen in the right atrium on echocardiography, although it was seen in the appropriate position on the chest radiograph taken on the day of insertion. After pericardiocentesis, the catheter tip was withdrawn and checked by saline contrast echocardiography and no passage was observed. The catheter was continued to be used and the effusion did not reoccur in the follow-up.

In conclusion, central venous catheters may be dislodged from their proper position in premature patients with weight loss and decreased abdominal circumference. It should be kept in mind that the central catheter may cause cardiac tamponade without perforation. The tip should be followed up with chest radiographs during use, and echocardiography should be performed in case of unexplained clinical deterioration, considering pericardial effusion and cardiac tamponade. In the presence of tamponade, it should be remembered that pericardiocentesis is a life-saving procedure.

Ethical approval

A written informed consent was obtained from the patient's family.

Author contribution

Surgical and Medical Practices: SÖ, RÖ; Concept: SÖ, KY, CK; Design: SÖ, RÖ, CK; Data Collection or Processing: SÖ, SB, NN; Analysis or Interpretation: SÖ, RA, KY; Literature Search: SÖ, RÖ, RA, NN; Writing: SÖ, RÖ, KY, NN. All authors reviewed the results and approved the final version of the article.

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Conflict of interest

The authors declare that there is no conflict of interest.

REFERENCES

1. Pizzuti A, Parodi E, Abbondi P, Frigerio M. Cardiac tamponade and successful pericardiocentesis in an extremely low birth weight neonate with percutaneously inserted central venous line: a case report. Cases J. 2010;3:15. [Crossref]

2. Warren M, Thompson KS, Popek EJ, Vogel H, Hicks J. Pericardial effusion and cardiac tamponade in neonates: sudden unexpected death associated with total parenteral nutrition via central venous catheterization. Ann Clin Lab Sci. 2013;43:163-71.

3. Elgendy MM, Aly H, Mohamed MA. The incidence of pericardial effusion requiring intervention in infants with a history of umbilical catheter placement: the US national database. J Perinatol. 2021;41:2513-8. **[Crossref]**

4. Abdellatif M, Ahmed A, Alsenaidi K. Cardiac tamponade due to umbilical venous catheter in the newborn. BMJ Case Rep. 2012;2012:bcr-2012-6160. **[Crossref]**

5. Elbatreek M, Shehata NB, Abu-Shaheen A, Almatary A. Neonatal pericardial effusion and tamponade after umbilical venous catheter insertion and the use of saline contrast echo as a diagnostic tool. Am J Case Rep. 2019;20:1382-6. **[Crossref]**

6. Nowlen TT, Rosenthal GL, Johnson GL, Tom DJ, Vargo TA. Pericardial effusion and tamponade in infants with central catheters. Pediatrics. 2002;110:137-42. **[Crossref]**

7. Chioukh FZ, Ameur KB, Hmida HB, Monastiri K. Pericardial effusion with cardiac tamponade caused by a central venous catheter in a very low birth weight infant. Pan Afr Med J. 2016;25:13. **[Crossref]**