Introduction

Percutaneously inserted central catheters (PICCs) are essential part of the neonatal intensive care units (NICU) and provide vascular access for critical medications and parenteral nutrition (PN). But they are also known to be cause of complications ranging from local, systemic infection to pericardial effusion, tamponade and even death (1). Incidence of pericardial effusion and cardiac tamponade associated with PICCs was reported as 0,1-0.18% in previous reports (2,3).

Herein, we present two premature neonates with pericardial effusion and tamponade due to PICC who were successfully treated by bed-side pericardiocentesis to emphasize that early diagnosis and pericardiocentesis might be life saving.

Case report

Case 1

A-24-day old male neonate was referred to our department because of sudden deterioration of his clinical status and cardiac arrest. He was born in 27^{th} gestational week, and weighing 1120 gr and hospitalized in NICU. PICC was inserted through left antecubital vein at the third day of hospitalization. Parenteral nutrition and antibiotherapy had been given by this route. At 22^{th} day of hospitalization bradycardia and cardiac arrest developed. Chest X-ray revealed cardiomegaly and echocardiography showed massive pericardial effusion with 'swinging heart' (Figure 1). Bed-side pericardiocentesis was performed and 15 ml milk colored PN fluid evacuated (Figure 2). Biochemical analysis of pericardial fluid revealed glucose 385 mg/dl, triglyceride 1034 mg/dl, albumin 18.8 mg/dl and cholesterol 4 mg/dl, White blood cell count was $25/mm^3$. In aerobic culture media no microorganism was observed. Following pericardiocentesis, the catheter immediately pulled out and the amount of pericardial fluid decreased and totally disappeared at the first day. Also his clinical status got better and mechanical ventilation discontinued.

Case 2

A preterm male neonate born with cesarean section at 28th week of gestation weighing 895 gr due to fetal distress and referred to NICU. The patient was diagnosed as stage 3 necrotising enterocolitis, and PICC was inserted through right antecubital vein at the first day of hospitalization. PN started through PICC. At the 15th day of his hospitalization his clinical status was deteriorated and generalized edema was developed. Chest X ray showed cardiomegaly (Figure 3). Echocardiography revealed significant pericardial effusion and bed-side pericardiocentesis performed resulting in 20 ml serofibrinous fluid removal. Biochemical analysis of fluid was similar to PN that revealed triglyceride 126mg/dl, glucose 285 mg/dl, albumin 14,2 mg/dl and cholesterol less than lower limit of the measurable range. In cell count WBC was 35/mm3, RBC was 74/mm3 and no growth occurred in aerobic culture medium.

Discussion

The use of central venous catheters is a routine and essential part of NICU. But PICCs may also lead to serious complications such pericardial effusion with or without cardiac tamponade, pleural effusion, venous thrombosis and catheter removal difficulties (1).

Pericardial effusion and cardiac tamponade are associated with high mortality, partly because of delayed recognition. In a retrospective nationwide study in United Kingdom, Beardsall et al. reported pericardial effusion/cardiac tamponade in 82 of 46,000 cases who were inserted percutaneous long lines in five year period. The frequency of pericardial effusion/cardiac tamponade was 0.18% and mortality rate was reported as 0.07% (2). Ohki et al. also described estimated frequency of pericardial effusion or cardiac tamponade as 0.1% (3).

Several risk factors have been proposed for development of pericardial effusion and cardiac tamponade in a neonate with PICC (4). Vascular wall inflammation and thrombosis, thinner musculature of neonatal atrium are more susceptible to damage (5) . It appears that there are two mechanisms responsible for development of pericardial effusion. First one is perforation of myocardium at the time of catheter insertion and the second is progressive damage due to hyperosmolar fluid to the integrity of the vascular

wall, resulting in either transmural diffusion of infusate or erosion of the line into the pericardial space (6,7). We thought that pericardial effusion in our cases was related with progressive osmotic damage due to hyperosmolar PN solution.

Pericardial effusion is most commonly related with catheter tips placed within heart chambers. As in our cases, catheter tip located in and/or migrated to right atrium may be closely related to mechanical complications (8). We also think that optimal catheter localization is the junction of right atrium and vena cava inferior or thoracic vena cava inferior. Also, tip position should be confirmed by X-ray or imaging modality and rechecked periodically (9).

Additional risk factors; catheter type and raw material can also be responsible for such complications (1). For example, open ended catheters as in our cases are more prone to cause progressive wall damage and transmural diffusion. In addition, polyethylene or polyurethane catheter in contrast to silastatic catheter has more risk for development of pericardial effusion (10). Our cases also have polyurethane catheters that may also increase the risk.

Conclusion

Although PICCs are an essential component of neonatal care, they are associated with serious complications such as pericardial effusion and tamponade. This complication should be considered in any newborn with PICC who presents cardiorespiratory instability and should be treated immediately.

References

1. Nolan ME, Yadav H, Cawcutt KA, Cartin-Ceba R. Complication rates among peripherally inserted central venous catheters and centrally inserted central catheters in the medical intensive care unit. J Crit Care. 2015 Oct 5. Article in press.

2. Bearsdsall K, White DK, Pinto EM et al. Pericardial effusion and cardiac tamponade as complications of neonatal long lines: Are they really a problem? Arch Dis Child Fetal Neonatal Ed 2003; 88:292-5.

3. Ohki Y Maruyama K, Harigaya A, Kohno M, Arakawa H. Complications of peripherally inserted central venous catheter in Japanese neonatal intensive care units. Pediatr Int. 2013 Apr;55(2):185-9.

4. Kayashima K. Factors affecting survival in pediatric cardiac tamponade caused by central venous catheters. J Anesth. 2015 Jul 10. Article in press.

5. Nowlenn T, Rosenthall GL, Johnson GL. Pericardial effusion and tamponade in infants with central catheters Pediatr 2002;110:137-142.

6. Gluszek S, Matykiewicz J. Cardiac tamponade as a complication of catheterization of the subclavian vein – prevention and principles of management. Nutrition. 2015;15(7–8):580–582

7. Schicchia R., Di Piazzab M., Bonomo V. A life-threatening complication of parenteral nutrition: how to prevent cardiac tamponade? Ann. Cardiol Angeiol 2013;63(4):265–266

8. Darling JC, Newell SJ, Mohamdee O et al. Central venous catheter tip in right atrium: a risk factor for neonatal cardiac tamponade. J Perinatol.2001;21:461-4.

9. Venugopal AN1, Koshy RC, Koshy SM. Role of chest X-ray in citing central venous catheter tip: A few case reports with a brief review of the literature. J Anaesthesiol Clin Pharmacol. 2013 Jul;29(3):397-400.

10. Aggarwal R, Downe L. Neonatal pericardial tamponade from a silastic central venous catheter. Indian Pediatr 2000; 37:564-66.

Figure Legends

Figure 1: Massive effusion in pericardial space.

Figure 2: Aspirated pericardial fluid.

Figure 3: Chest X- ray shows cardiomegaly.