

Bedside Echocardiography by the Neonatologist for an Early Diagnosis of Pericardial Tamponade and for Performing Life Saving Pericardiocentesis

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Abstract

This article will emphasize on the importance of Bedside point of care Echocardiography which can be life saving to any at risk neonates. The hands on experience of the Neonatologist in echocardiography to understand life threatening conditions like pericardial tamponade should be an essential part of neonatal training [1-3].

Umbilical venous catheter is the most common type of central venous catheter placement in all Neonatal ICU. Complications related to such central lines are numerous but the two main life threatening complications are pericardial effusion and pericardial tamponade. Early diagnosis and early intervention is lifesaving. Routine functional echocardiography for any neonate with central lines having fluctuating Heart rate and Blood pressure at the earliest by the neonatologist is diagnostic as well as therapeutic for such rare but life-threatening complications.

We are presenting a 27 weeks premature baby who developed sudden onset in hemodynamic instability which turned out to be due to Umbilical venous catheter related pericardial tamponade. As the cause for sudden deterioration in the clinical status was not clear an urgent bedside echocardiography was performed which turned out to be crucial in clinching the diagnosis and deciding on immediate pericardiocentesis.

Mortality rate in Neonates are very high with pericardial tamponade. Although fatal in neonates however it is potentially reversible when diagnosed and intervened on time.

Keywords: *Echocardiography; Neonatologist; Pericardial Tamponade; Pericardiocentesis*

Introduction

This case tells us about the importance of bedside echocardiography performed by the Neonatologist both for diagnostic and therapeutic purpose. The time sensitive diagnosis and intervention is lifesaving.

Cardiac tamponade secondary to pericardial effusion is a rare but is a life-threatening complication of central venous catheters including PICC line. High index of suspicion in a neonate with central venous catheter developing cardiovascular dysfunction or compromise

is the only way to tackle this life-threatening emergency. A bedside echocardiography can confirm the diagnosis and can be lifesaving in such instances.

Case Presentation

An extremely preterm 27 weeks neonate with birth weight of 850g was electively intubated and ventilated for Respiratory distress syndrome and was on volume guaranteed ventilation at birth. At birth umbilical venous and arterial catheter were inserted to provide nutrition and for invasive BP monitoring. The position of the catheter tip was confirmed with x ray.

On day 3 of life we observed a sudden drop in the heart rate and saturation with gradual deterioration and in another couple of minutes baby required extensive resuscitation in the form of chest compression and adrenaline. Though the neonate responded to the resuscitation but started having frequent desaturation, bradycardia along with hypotension. Portable X ray of the chest showed a high positioned umbilical venous tip and a doubtful cardiomegaly. The umbilical venous catheter was immediately pulled back and an bedside echocardiography was performed. Echocardiography done was suggestive of Pericardial effusion with tamponade and compromised cardiac function. As the clinical condition was rapidly deteriorating we need an urgent pericardiocentesis as it is lifesaving. We did not have time to wait for the cardiologist to arrive so we decided to proceed for an urgent pericardiocentesis. An echo guided pericardiocentesis through a sub xiphoid approach and drained 7 ml of pericardial fluid.

There was dramatic improvement in the clinical status following the pericardiocentesis with complete normalization of the blood pressure and heart rate.



Four chamber view showing pericardial Effusion.



Chest xray showing massive cardiomegaly

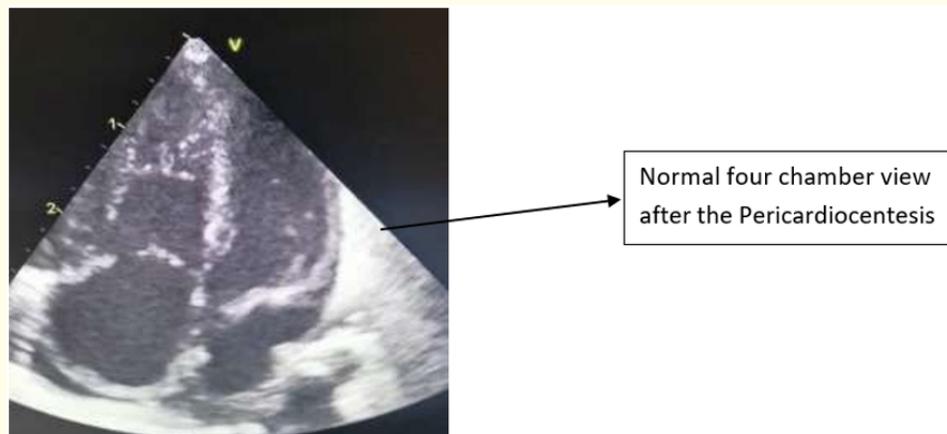


Figure 1: Head screw size vs frequency of usage.

Discussion

There is a lot of emphasis on functional echocardiography in the present world of Neonatology. The role of functional echocardiography is rapidly evolving. It is considered as an extension of clinical examination for cardiovascular evaluation in a critically ill neonate. It refers to a bedside echocardiographic assessment of the hemodynamic status, Patent ductus arteriosus, myocardial performance and pulmonary or systemic haemodynamics that is brief in nature and addresses a specific clinical question or management dilemma. This point-of-care ultrasonography is increasingly used internationally and locally among neonatal units to assist with management of neonatal haemodynamic conditions [1-3].

Central line placement for administration of parenteral nutrition and other medications has become an essential parts of managing neonates in all Neonatal ICU's all over the world. So, the complications associated with such line are not unusual like infection, catheter block, thromboembolism, catheter migration and pericardial effusion and tamponade. So utmost vigilance and monitoring is essential after insertion of any UAC, UVC, PICC line or any central line.

Abnormal collection of fluid between visceral and parietal layer of pericardium which in turn predisposes to decrease cardiac output and heart contractility [4]. The catheter tip position is considered appropriate if it remains outside the cardiac silhouette, approximately 2 cm outside the silhouette in term and 1 cm in preterm neonates.

Pericardial effusion may be caused by multiple reasons including direct injury of myocardium wall, hyperosmotic damage that may be caused by infusion of total parenteral nutrition (TPN), and necrosis of myocardium wall due to frequent contact of the myocardium with the tip of the catheter.

In spite of a satisfactory position of UVC tip we still tend to see pericardial effusion and cardiac tamponade, most probably happened because of the hyperosmolar parenteral nutrition infusion that caused endocardial injury and further penetration of this fluid into the pericardial sac [5,6].

The main risk factors: ELBW, gestational age inferior to 28 weeks, CVC in intracardiac position and parenteral nutrition infusion. International recommendations state that the tip of the catheter should be located outside the cardiac outline.

Srinivasan, *et al.* concluded that migration of the catheter was frequent and recommended a follow-up X-ray 24 hours after the insertion [7]. To avoid this complication, some NICUs adopted the policy to regularly verify the position of the PICC. Another possible reason is that measurement methods used (Dunn and Shukla) may not be valid for premature infants, especially those with ELBW [8-12].

Ultrasound guidance provide direct visualisation and more precision and less complication. We performed a subxiphoid (SX) approach

The probe is placed in the subxiphoid area angled up into the chest using the liver as a window. Pericardial effusion will be seen as a black anechoic area above the right ventricle and this should be where the needle should enter the pericardium. This distance can be measured in between the place where the needle will be inserted and the pericardial effusion by using the measurement markers on the monitor screen. The needle should be inserted parallel to the probe and directed at a 45° angle towards the left scapula tip. The needle will appear on the screen as a hyperechoic structure with reverberation artifact and should be used to guide the advancement towards the pericardium. The syringe should be aspirated as the needle is advanced every 1 - 2 mm until fluid is drawn back.

Confirmation of the position was confirmed as we aspirated clear fluid up to 7 ml. Removal of 5 - 10 mL of fluid can increase the stroke volume by as much as 25 - 50% and result in a dramatic increase in cardiac output and blood pressure evidenced by an improvement in the patient's vital signs.

Complications of Pericardiocentesis are dry tap, pneumothorax, myocardial injury, arrhythmias, cardiac arrest (needle can perforate the RV or a coronary artery resulting in worsening tamponade), Liver injury (with subxiphoid approach) [13].

Conclusion

Bedside echocardiography performed by the Neonatologist at times are life saving, as it has both for diagnostic and therapeutic purpose. Cardiac tamponade secondary to pericardial effusion is a rare but is a life-threatening complication of central venous catheters including PICC line. High index of suspicion in a neonate with central venous catheter developing cardiovascular dysfunction or compromise is the only way to tackle this life-threatening emergency. A bedside echocardiography can confirm the diagnosis and can be lifesaving in such instances.

It would be ideal to do a bedside echocardiography for any neonate with central lines to rule out or treat such life threatening condition. Ultrasound Guided pericardiocentesis [14] makes the procedure more Precise and successful and with lesser complication risk.

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