Unusual Cause of Ventricular Fibrillation in a Four-Year-Old Child: Port-A-Cath Fracture and Embolization into the Heart

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Port-A-Catheters are inserted in pediatric cancer patients to provide long-term vascular access for chemotherapy and frequent blood sampling. Common complications are infections, malfunction, and thrombosis. Uncommon complications are catheter fracture, catheter migration and dislodgment; however, these uncommon complications could be life-threatening.

We present a case of totally implanted port-a-catheter (TIVAP) fracture and migration into the heart causing life threatening ventricular fibrillation in a four-year-old boy during TIVAP removal, which was treated successfully by adequate preventive management and removal of the embolized fragment.

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Totally implanted port-a-catheter (TIVAP) insertion provides long-term vascular access for chemotherapy and frequent blood sampling in pediatric cancer patients[1]. Complications include infection (tunnel infection and catheter-related blood-stream infection), malfunction and thrombosis. Catheter fracture, migration, and dislodgment are uncommon complications but could be life-threatening, especially in pediatric patients, with an estimated rate of 0.1-4%[2,3].

The aim of this presentation is to report a case of TIVAP fracture and migration into the heart causing life-threatening ventricular fibrillation in a four-year-old boy during TIVAP removal.

A four-year-old boy with pancreatic cancer had pancreatectomy one year ago. A TIVAP was implanted into his right internal jugular vein by a percutaneous technique for adjuvant chemotherapy. He subsequently received nine cycles of chemotherapy and was admitted 15 months later for removal of the port, which had been unused and non-functioning for the past 6 months.

After applying the ASA standard monitoring, pre-anesthesia evaluation showed blood pressure 109/52, heart rate 105 and oxygen saturation 98% measured by pulse oximetry. Therefore, general anesthesia was induced using propofol and fentanyl and maintained with sevoflurane in oxygen. During surgery, the port reservoir was dissected; however, the surgeon encountered difficulty during catheter removal. Following several attempts, the surgeon succeeded to retrieve the catheter. However, he noticed that a missing part is still inside the vessel. A chest radiograph showed the catheter to have embolized into the junction of superior vena cava (SVC) and right atrium (RA), see figure 1. The patient was transferred to interventional radiology to remove the fractured part of the catheter percutaneously through femoral approach. While attempting to retrieve the fractured part, it slipped into the inferior vena cava (IVC) and migrated through the right ventricle (RV) to the left pulmonary artery (PA). The patient suddenly developed ventricular fibrillation with vital signs instability associated with decreases in end-tidal CO2 (EtCO2) from 40 mmHg to 10 mmHg with no reading of pulse oximetry and absence of pulse.

While preparing for cardioversion, we noticed that whenever the surgeon pulls the catheter down away from the heart, the rhythm returns to normal sinus. Spontaneous conversion to the normal rhythm has been observed following several episodes of VF during the manipulation attempts to pull out the fractured part of the catheter. Hence, it was decided to start medical preventive treatment to decrease the harmful effect of VF episodes. Oxygen flow rate (FiO2) was increased to 100%, minute ventilation was adjusted (tidal volume and respiratory rate) to avoid hypocapnia and subsequent cerebral effect. Hydration with 100 ml of balanced fluids was administered for vital signs stabilization. A transient hyperdynamic phase characterized by high blood pressure and tachycardia (defined as >30% of baseline readings) has been observed following every period of VF. The duration of each VF episode was estimated less than 60 seconds. There was no cardiovascular collapse following the return of spontaneous circulation (ROSC) after all VF events. The embolized fragment was finally extracted one hour later after several attempts without further complications. The patient was discharged the next day with stable vital signs and no further event.

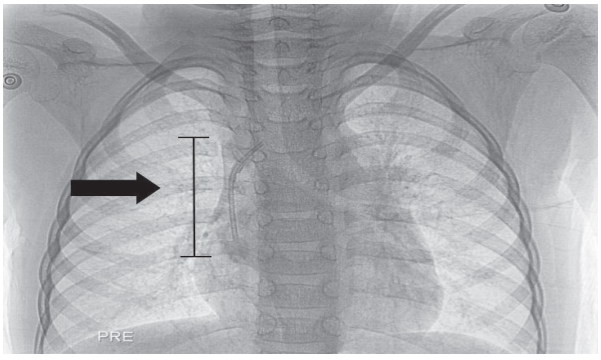

Figure 1: Shows the Embolized Port-A-Catheter Fragment into the Right Heart

DISCUSSION

The totally implantable catheters system has been accepted widely as venous access when prolonged treatment is needed. Complications include malposition, pneumothorax, hemorrhage, thrombosis, infection and dysfunction[3]. However,

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despite its repeated use, intravascular fracture and embolization of catheter fragments are rare, but potentially life-threatening complication. It has been reported that disconnection between catheter and the port is most likely a result from the patient's body movement, trauma or difficulty during removal. Although removal should be easy by simple incision, it could be difficult and require sternotomy[4-6]. The phenomenon of difficulty has been previously described in pediatric patients.

In a series of 200 children, Guineva et al reported 32 (16%) cases of difficulty related to TIVAP removal procedures[7]. It has been shown that adherence and fixation to the wall vessel is the main cause for catheter retention. This might increase the risk of catheter fracture and embolization during manipulation removal. The most common presentation of catheter embolization is asymptomatic discovery on chest radiology. However, migration into the heart could be associated with cardiac complications such as cardiac arrhythmias.

In 1984, Aitken and Minton were the first to report catheter fracture and embolization into the right pulmonary artery with no symptoms and was removed transcutaneous[8]. Adverse events from catheter fracture emboli have been reported with no serious complications in patients who underwent removal of the embolized catheter.

The cause of failed retrieval of embolized fragments include the absence of free end, small fragments, entrapments deep into vascular wall, and escape outside the vessels. However, failure to remove intravascular foreign bodies could result in serious complications and could lead to death[9].

The highest mortality and morbidity was observed when the foreign body was detected in the right heart or in the vena cava and in the pulmonary artery. Causes of death included septic endocarditis, thrombosis of vena cava leading to pulmonary embolism, cardiac wall necrosis and sepsis, and arrhythmia with cardiac failure[9,10]. Liu et al reported 20 centrally embolized dislodged port-a-catheter fragments, 18 were intracardiac and 2 distally located in the pulmonary artery[10]. All the percutaneous foreign body retrievals were performed without complication except transient atrial and ventricular arrhythmia during the retrieval procedures in five cases. No medicine was required for these episodes of cardiac arrhythmia.

Electricity and antidysrhythmic therapy might be unsuccessful due to the mechanical nature of the myocardial irritation. Our case presented with frequent episodes of life-threatening ventricular fibrillation triggered by catheter fragment migration into the heart. This finding was not previously reported in children. Conservative treatment was successful as the patient showed stable cardiovascular conditions post-VF episodes. For unstable patients, we recommend the following PALS guidelines.

Our reported case highlighted several important aspects: (i) it is the first report of catheter embolization complicated by VF in children. (ii) VF could be reversed without cardioversion due to the mechanical nature of the myocardial irritation. (iii) The embolized catheter could be retrieved without surgical intervention. (vi) Preventive measures (oxygenation and hydration) possibly helped in avoiding cardiovascular hemodynamic changes following short time VF. It has been shown that the onset of cardiovascular collapse post-ROSC was obviously related to the duration of VF. Ventricular fibrillation >3min is associated with a high incidence of hypodynamic phase and subsequent cardiovascular collapse post-ROSC[11]. In our case, all VF episodes lasted <3min and we did not experience any post-VF hemodynamic collapse.

CONCLUSION

Our patient presented with a very rare, potentially lethal dysrhythmia secondary to the mechanical irritation of the myocardium by the embolized catheter. It was treated successfully by adequate preventive management and removal of the embolized fragment. Finally, care of the catheter and the patient should be maintained to decrease the risk of complications.

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