Migration of catheter of a totally implantable venous access port to right thoracic cavity in a child - a case report

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Case report

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Abstract

Background: The totally implantable venous access port (TIVAP) is a secure and practical choice for children undergoing long-term chemotherapy. Nevertheless, various complications still need to be treated cautiously. Among the complications, the migration of catheters to the thoracic cavity is a very rare (but potentially severe) condition that may necessitate device reimplantation. Furthermore, this migration may even be life-threatening if it is not detected in time.

Case presentation: A 1-year-old girl undergoing palliative chemotherapy underwent TIVAP placement via the right internal jugular vein. During the operating procedure, the catheter tip was located in the right atrium, which was confirmed by the use of C-arm. Prophylactic intravenous antibiotics were then adopted with routine aspiration and with flushing being conducted each time before administration. Massive right pleural effusion and migration of the catheter tip to the right thoracic cavity were detected on the 2nd day after implantation, which resulted in the removal and reimplantation of the TIVAP device.

Conclusions: The migration of the catheter into the thoracic cavity should be considered a possible complication of TIVAP implantation in children. Early detection and reimplantation may provide opportunities for the prevention of further severe complications.

Background

Secure central venous access is of great importance in cancer patients, especially in children who require long-term intravenous chemotherapy, as chemotherapy drugs are toxic to the peripheral veins[1]. After being first introduced by Dr. Niederhuber in 1982[2], the totally implantable venous access port (TIVAP) is now widely used in clinical oncology and has been demonstrated to be a safe and reliable choice for children requiring long-term chemotherapy[3]. However, various complications, such as infection, thrombosis, catheter fracture and catheter migration, associated with catheter placement and long-term use, remain a matter of concern, with some of the concerns necessitating device replacement. Additionally, some concerns can even be life-threatening if they are not detected early[4]. Among these complications, catheter migration is relatively rare and can mainly be observed during the invasive procedure as a primary dislocation[4–6]. In addition, the tips of the catheters have also been reported to migrate towards the internal jugular vein (IJV) or towards the brachiocephalic vein as a postoperative complication[3, 7]. To the best of our knowledge, we report of the first case of catheter migration towards the thoracic cavity as a postoperative complication following TIVAP implantation in a child.

Case Presentation

A 1-year-old girl was diagnosed with hepatoblastoma with inferior caval vein thrombus and underwent chemotherapy with cisplatin and porarubicin as palliative treatments. After failing to implant the peripherally inserted central catheter twice, the girl underwent TIVAP placement in the operating theatre by an anaesthetist under general anaesthesia. The IJV was punctured percutaneously by using the Seldinger

technique under direct ultrasound visualization, during which the entrance was made approximately 0.5 cm down the midpoint between the two heads of the sternocleidomastoid muscle. Next, a guidewire was inserted into the vein through the needle and was positioned in the right atrium (Fig. 1). With the help of this guidewire, the catheter was introduced into the right atrium (with the tip of the catheter being confirmed via C-arm), and the TIVAP septum was then placed into a subcutaneous pocket in the right anterior chest wall (Fig. 2). Subsequently, the port system was aspirated to confirm the free flow of blood and was flushed with heparinized saline (100 IU/ml) each time before the administration of routine prophylactic intravenous antibiotics.

On the 2nd day after implantation, unobstructed aspiration of slightly bloody fluid was detected before the injection of heparinized saline. Consequently, an injection test under ultrasound visualization was adopted to verify the location of the catheter tip. As no microvesicles were observed via ultrasound during the bolus injection of saline, the catheter tip was suspected to be absent from the optimal position. Therefore, an adjustment was immediately made under intraoperative fluoroscopy, which revealed massive right pleural effusion and the migration of the catheter tip to the right thoracic cavity (Fig. 3). The TIVAP, through which the pleural effusion was absorbed (Fig. 4), was then surgically removed (Fig. 5) and replaced with a new TIVAP. A chest X-ray was routinely performed to visualize the location of the catheter tip before the next chemotherapy course, and the optimal location of the catheter tip was confirmed (Fig. 6). There were no early complications during this procedure.

Discussion

TIVAPs provide secure and reliable central venous access for intermittent long-term infusion therapies[4, 8], which are convenient for cancer patients to ensure the safe delivery of chemotherapeutic drugs, the transfusion of blood products and the performance of laboratory tests[9]. When compared with externally tunnelled catheters, TIVAPs are particularly desirable for children undergoing long-term chemotherapy, as the catheters require less maintenance and do not limit daily activities, such as taking a bath. More importantly, TIVAPs are invisible from outside view and have little risk of accidentally being pulled out of the tunnelled catheter, which is more acceptable by the parents[8].

Despite these various advantages, certain complications that are associated with the implantation procedure or the long-term use of the TIVAP may occur[10]. These complications can be divided into 3 main categories: procedural complications (such as haemothorax, pneumothorax, cardiac arrhythmia, injury of the brachial plexus and catheter malposition), early complications (occurring before the first chemotherapy application, such as pocket haematoma and fibrin formation) and late complications (occurring after the first chemotherapy application, such as thrombosis, infection, “pinch off” syndrome, catheter rupture, embolization, extravasation and catheter migration)[4, 11–13]. Among all of these reported complications, catheter migration is rarely seen but is regarded as being a potentially severe condition, which can likely lead to TIVAP replacement or removal. To the best of our knowledge, this is the first case in which the migration of the TIVAP catheter tip to the right thoracic cavity occurred in a child as an early complication. In the present case, catheter migration to the thoracic cavity was detected by the

aspiration of slightly bloody fluid without obstruction at 2 days after implantation as an accidental finding and was subsequently confirmed via ultrasound and fluoroscopy. It is clinically asymptomatic and likely to be carelessly ignored, which may result in more severe events if chemotherapeutic drugs are injected into the thoracic cavity.

Several plausible reasons are considered to have contributed to catheter migration in this child. First, the lower puncture point on the neck and the more vertical pathway may have led to the condition in which the guidewire inadvertently went through the thoracic cavity before entering into the IJV or superior vena cava. Although the puncture procedure was performed by a senior anaesthetist under ultrasonographic guidance, which has been demonstrated to significantly reduce the complication rate[14–16], a suspected vascular puncture still occurred due to imprudent surgical manoeuvres as, in retrospect, the introducer needle was placed under the skin for a relatively long pathway before entering into the lumen. The special body constitutions of children, such as a short neck, may possibly contribute to the improper selection of the puncture point and pathway angle, which may account for catheter migration into the thoracic cavity. In addition, the type of catheter, the entry point into the IJV and the 'out-of-plane' puncture approach are also associated with catheter migration after TIVAP insertion via the IJV[17]. The standardized TIVAP implant procedure, extensive insertion experience and adversarial repeated puncture attempts are reported to reduce the complications of catheter insertions[18, 19]. Second, undue pressures developed by bolus flushing and peristaltic pumps may also increase the risk of catheter migration. Therefore, the flushing of the catheter should be performed in a gentle manner[20, 21], and the limited speed of the peristaltic pump may aid in the prevention of catheter migration. Third, excessive movement and frequently increased intrathoracic pressure (as a result of the active lifestyle and lachrymose characteristics of children) may also potentially contribute to migration. In addition, the risk of catheter tip migration has been reported to be associated with the short catheter length inserted into the body and the shallow tip location[5].

When considering the various early complications of TIVAP implantation, delayed usage of catheters with an 8-day interval is advised[22]. Although periprocedural antibiotic use is controversial and has not been verified to be associated with long-term infection rates[23], we suggest the routine application of prophylactic antibiotics through the TIVAP for 48 hours, which may decrease the early infection rate and aid in the detection of early complications. In addition, regular follow-ups with chest radiography and flushing with heparinized saline each time before the application of the TIVAP device are indispensable[24]. If unobstructed aspiration of slightly bloody fluid is detected before the flushing with heparinized saline, a chest radiograph should be immediately performed to investigate the possibility of catheter migration into the thoracic cavity, as the early detection of the migration and reimplantation of the TIVAP device may aid in the prevention of further complications. It is sometimes difficult to identify the accurate position of the catheter tip via X-ray imaging, and two feasible methods may aid in probing whether the catheter tip is in the thoracic cavity. The first method is to confirm the occurrence of a hydrothorax via chest radiography after the injection of saline solution through the TIVAP. The second method is to observe whether there are any microvesicles in the right atrium via ultrasound during the bolus injection of saline solution through the TIVAP.

Conclusions

Catheter migration into the thoracic cavity should be considered as being a possible complication of TIVAP implantation in children, especially when the backflow from the TIVAP is slightly bloody. The migration could be explained by the lower puncture point on the neck and the more vertical pathway, as well as due to undue pressures developed by the bolus flushing and peristaltic pumps, excessive movement, frequently increased intrathoracic pressure and the short catheter length and shallow tip location. The early detection and reimplantation of the TIVAP device are of great importance and might aid in the prevention of further life-threatening complications.

Abbreviations

TIVAP Totally implantable venous access port

IJV Internal jugular vein

Declarations

Ethics approval and consent to participate

Not applicable.

Consent for publication

Written informed consent for publication was obtained from all participants.

Competing interests

The authors declare that they have no competing interests.

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Authors' contributions

Shuhua Duan had the idea for the article, Qiteng Xu, Yueyi Ren and Yifei Hu performed the literature search, Rui Chen and Junhui Yuan critically revised the work. All authors read and approved the final manuscript.

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Figures

Figure 1

Guidewire positioned in the right atrium

Figure 2

The catheter tip positioned in the right atrium

Figure 3

Massive right pleural effusion and migration of the catheter tip into right thoracic cavity

Figure 4

Pleural effusion absorbed through the TIVAP

Figure 5

TIVAP, which was surgically removed

Figure 6

Chest X-ray routinely performed to visualize the location of the catheter tip