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Opportunistic Insertion of Implantable Venous Access Port Through Persistent Left Superior Vena Cava: A Report of 2 Cases and Literature Review

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1. Abstract

Breast cancer has been the greatest threat to female all over the world. There are various therapies to cure this common disease, such as surgery, chemotherapy, radiotherapy, immunotherapy and so on. Implantable Venous Access Port has been widely used in breast cancer chemotherapy. We found two patient had Persistent Left Superior Vena Cava accidently, while had PORT implanted via their internal jugular vein. The purpose of this article is to introduce our two rare cases and review relative literature.

Implantable Venous Access Port (IVAP, referred to as PORT) has been widely used in intravenous therapy of breast cancer due to the advantages of less vascular-related complications, low incidence of local infection and catheter displacement [1]. PORT recommends percutaneous internal jugular vein and subclavian vein catheterization, as well as basilic vein and femoral vein [2]. Among the cases of PORT implantation via internal jugular vein in our department, 2 cases were opportunistically found which were implanted through permanent left superior vena cava (Persistent Left Superior Vena Cava, PLSVC). In embryology, PLSVC is due to the fact that the left anterior main vein is not closed at 12 weeks of pregnancy, resulting in the confluence of the left common jugular vein and the left subclavian vein cannot return to the right superior vena cava, but travel downward before the aortic arch and the left pulmonary hilum, and receive blood from the left superior intercostal vein and semi-azygos vein, and then pass through the pericardium into the coronary sinus (Coronary Sinus, CS) or left atrium[3]. PLSVC is a rare venous malformation, which has a certain influence on the implantation of PORT due to its different course. This paper reports 2 cases of opportunistic intravenous PORT, implantation via PLSVC and reviews the related literature.

2. Cases Introduction

(Informed consent has been obtained from the patient for publication of the case report and accompanying images.)

Mrs Zhao, a 40 years old woman who was admitted to hospital with "double breast mass found for more than one month" as the main complaint. Then her puncture biopsy confirmed right breast cancer with lymph node metastasis(T2N1M0) and left breast ductal carcinoma in situ. After the diagnosis was confirmed, subcutaneous adenectomy of the right breast, axillary lymph node dissection and breast prosthesis reconstruction were performed under general anesthesia, so did the left. Postoperative pathology: Mucinous carcinoma of the right breast at 10, 11:00 and 12:00 (size 2.5cm, 0. 7cm, 1. 2cm), 1/16 cancerous tissues were found in the right axillary lymph node, immunohistochemistry suggests ER (80%), PR (90%), Her-2 (-), Ki67 (30%); Left breast papilloma with focal ductal epithelial atypical hyperplasia, formation of intraductal carcinoma, reactive hyperplasia of sentinel node (5), immunohistochemistry suggests: ER (+), PR (+), Ki67 (5%). The patient recovered well after operation and received adjuvant chemotherapy with AC-T regimen and adjuvant radiotherapy on the right side. The right breast mass of the patient mucinous carcinoma with axillary lymph node metastasis, so adjuvant radiotherapy was needed after breast conserving surgery, so PORT is implanted through the left internal jugular vein. The whole process of implantation was completed under the guidance of B-ultrasound, the operation was smooth, blood return and infusion were smooth. The Orthotopic chest radiography after operation showed that the PORT catheter of the patient ran beside the left mediastinum

(Figure 1), which was different from that of normal people who were implanted with PORT through the left internal jugular vein. In order to determine the catheter path and evaluate whether it was necessary to adjust the position and path, chest enhanced CT was performed by median venography. Then the patient with the presence of PLSVC was proved, contrast medium finally flowed into the right atrium through the coronary sinus (Figure 2). PORT was implanted through PLSVC, and the tip of the catheter was located at the nipple level. Catheter/Vein<45%, so there was no need to adjust the PORT, the use of PORT during adjuvant therapy was smooth, and the catheter was removed at the end of treatment.

Mrs Liu, a 54 years old woman, whose puncture biopsy showed right invasive breast cancer with axillary metastasis. Immunohistochemistry suggested ER (-), PR (-), AR (+) 2%, Her-2(2+), Ki67(+)50%, CK5/6(-), FISH (-). Neoadjuvant chemotherapy was given before operation, and PORT was successfully implanted under the guidance of ultrasound. Positive chest X-ray examination after operation showed that the catheter ran beside the left mediastinum and the end was located in the seventh thoracic vertebra (Figure 3), it is an opportunistic discovery of PLSVC, PORT implantation via PLSVC in patient. In the same way, chest enhanced CT was performed by median venography to determine the course of blood vessels, and PLSVC converged into the right atrium through the coronary sinus (Figure 4). Excluding the contraindications of chemotherapy, adjuvant chemotherapy AC-T and radiotherapy was given, and PORT was used smoothly during the adjuvant therapy. The catheter was removed at the end of treatment.

Figure 1. The catheter walks beside the left mediastinum

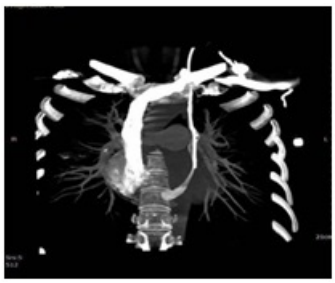

Figure 2. Contrast medium flowed into the right atrium through the coronary sinus

Figure 3. The catheter walks beside the left mediastinum

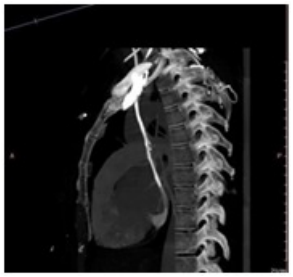

Figure 4: PLSVC converged into the right atrium through the coronary sinus

3. Discussion

PORT is a fully implantable vascular channel device that can be punctured repeatedly. Intravenous therapy for tumor patients is an absolute indication for PORT implantation. Compared with the past, PICC can effectively reduce the incidence of peripheral phlebitis and vascular sclerosis, and reduce the necrosis of surrounding tissue caused by drug extravasation [4]. Secondly, patients' daily activities are rarely restricted, easy to use and maintain, and use for a long time, which can protect patients' privacy, improve quality of life and satisfaction [5], [6].

In the above two cases, after the PORT was implanted through the left internal jugular vein, the chest radiography showed that the catheter was abnormal-the catheter was located next to the left mediastinum rather than the superior vena cava. CT angiography confirmed that the PORT catheter did not normally flow into the right superior vena cava through the left common jugular vein, but into the CS through PLSVC and then into the right atrium. Permanent Left Superior Vena Cava(PLSVC) was first discovered by Edwards and Dushane. It is a rare venous malformation, with an incidence of 0.3% to 0.5% in normal people and 3% to 10% in patients with congenital heart disease [7]. Especially in atrial septal defect, ventricular septal defect, coarctation of aorta, transposition of major vessels, tetralogy of Fallot, abnormal pulmonary venous connection, etc., the incidence of PLSVC is as high as 12% [8]. However, no abnormality was found by cardiac color Doppler ultrasound in these two patients. PLSVC is caused by abnormal degeneration of the left anterior main vein, which starts in front of the left jugular vein and the left pulmonary artery and the lateral edge of the left atrium, converges into the CS, through the left atrioventricular sulcus and finally enters the right atrium [9]. According to the location of the flow into the heart, PLSVC is often

divided into four types: type I: PLSVC flows into the coronary sinus, the right superior vena cava is absent, accounting for 10%-20%; type II: there is no communicating branch between the two superior vena cava, accounting for 50%-60%; type III: both sides of the superior vena cava exist, there are communicating branches between them accounting for 25%,-30%; type IV: PLSVC flows into the left atrium, accounting for 10%-20% [10]. Because most PLSVC flow into the right atrium, and there are no communicating branches between the left and right superior vena cava, there is no obvious effect on hemodynamics, so the patients generally have no symptoms and are not easy to find in clinic. In recent years, due to the development of medical devices and the improvement of interventional technology, more and more PLSVC have been found in cardiac pacemaker implantation, intravenous infusion port implantation, and PICC. However, there are few reports on the risk and experience of deep venous catheterization after PLSVC implantation. This paper makes a detailed report on the evaluation and use of PORT in 2 patients and summarizes the related literature.

The effect of PLSVC on PORT implantation is mainly manifested in the change of implantation path caused by abnormal vascular flow. It is generally difficult to find the existence of PLSVC before operation, and the catheter shape abnormality is found after opportunistic PLSVC implantation. PLSVC catheterization is prone to the following complications: (1) obstruction of catheter entry; (2) catheter misplacement into the right atrium; (3) too short catheter implantation and slow PLSVC blood flow velocity can easily lead to thrombosis; (4) increased risk of infection caused by prolonged operation time; (5) change of coronary sinus structure and venous flow velocity. This paper reports the use of PORT in neoadjuvant chemotherapy and adjuvant chemotherapy for breast cancer. No obvious abnormality was found during the operation, and the normal use of PORT was verified during the operation. However, if there is difficulty in entering the guide wire or catheter through the left internal jugular vein, the possibility of PLSVC should be considered. Under the guidance of B-ultrasound or X-ray in time, PORT can be implanted normally. The need for catheter adjustment or re-implantation through other venous pathways requires assessment of PLSVC.

In this 2 patients, chest CT was performed through the ipsilateral median vein, and the contrast medium was imported into the right atrium through PLSVC. At the same time, it showed that the ratio of the outer diameter of the PORT catheter to the internal diameter of the PLSVC vessel was less than 45%, suggesting that the venous velocity was normal, so the PORT could be used and the catheter path was not adjusted in both patients. How to find PLSVC before operation to avoid opportunistic implantation of PORT through PLSVC is conducive to the early selection of other venous pathways, which can be judged by CS. The average caliber of CS was 4.75mm in diastole and 8.27mm in systole [11]. Taking the end-systolic diameter of coronary sinus orifice (CSOESD) ≥ 16mm as the critical value, the sensitivity, specificity and accuracy of identifying persistent left superior vena cava were 90.99%, 91.1% and 91.1%, respectively. [12]. When improving the relevant examination before PORT implantation, echocardiography should be recommended to evaluate CS, which has the advantages of non-invasive, simple and high repeatability, and can be used as the first choice for examination of PLSVC [13]. The position of the catheter should be confirmed by routine chest X-ray after the intravenous infusion port was implanted into the right subclavian vein and the ideal end of the catheter should be at the T5-7 level [14], [15]. The postoperative CT of these two cases showed that PORT was walking on PLSVC, and the tube orifice was at the level of the nipple. In addition to routinely evaluating the position of the end of the catheter, the appropriate type of catheter should be selected according to the vascular conditions of the proposed catheter. it is recommended that the ratio of the outer diameter of the catheter to the inner diameter of the indwelling vein is less than 45% [16]. According to the evaluation, the external diameter of the catheter is 6F, that is, the outer diameter of the catheter is about 1.91mm, and the inner diameter of the indwelling vein is 4.75mm and 4.83mm respectively, which meets the conditions of pipe placement. No catheter adjustment was performed in 2 patients, and the adjuvant chemotherapy was completed as planned. The effect of chemotherapy was not significantly different from that of the patients in the same period. It is speculated that the reason may be that the two cases are type II PLSVC, which does not affect hemodynamics, and has no obvious effect on the absorption, distribution, metabolism and excretion of chemotherapy drugs. Common intraoperative complications such as pneumothorax (and/or hem thorax), air embolism, arterial injury, pericardial tamponade, etc., did not occur during the operation. [17] Skin and soft tissue injuries caused by infection or non-infectious reasons, phlebitis catheter-related infection, catheter-related thrombosis and other common postoperative complications [18] did not occur also. After the treatment, the catheter was removed, and all indicators were normal in regular review. The patient was followed up for more than a year, and the patient's health and quality of life were significantly improved.

In summary, when opportunistic insertion of Port through PLSVC occurs in clinical work, it is necessary to calmly analyze and perform echocardiography and chest enhanced CT for confirmation in time. Pay attention to assess whether the ratio of the inner diameter of the PLSVC to the outer diameter of the catheter meets the conditions for implantability, assess the need to adjust the catheter and vascular path, assess whether PORT can be used normally, At the same time, it is recommended to routinely perform cardiac ultrasound to assess the condition of the coronary sinus when PORT is implanted through the left internal jugular vein, so as to improve the acuition of PLSVC in clinical work, improve the accuracy of diagnosis and treatment, and achieve precise and individualized treatment.

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