Peripherally inserted central catheters (PICC) in patients with mediastinal tumor under upper limb

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ABSTRACT
Objective: To analyse the various surgery programs on patients with mediastinal tumor who accept PICC catheter under upper limb, and discussing the methods of nursing care. Methods: A total of 10 cases, including the surgery programs, postoperative nursing and complications prevention, were retrospectively analyzed that patients with mediastinum tumor accept PICC catheter in upper limbs. Results: 10 cases of PICC catheter, including 4 cases of left upper limb and 6 cases of right upper limb with PICC, were completed successfully with complete preoperative assessment, preoperative discussion and preparation, closely monitoring patients during operation, good doctor-nurse cooperation, and seasoned operators. After careful nursing, all patients have completed chemotherapy successfully, whose tube indwelling time from 3 to 12 months, without unscheduled extubation. Conclusion: Patients with mediastinum tumor should be comprehensively assessed by colour-Doppler ultrasound in upper limbs and the chest CT, which helping to check the size and compression degree of tumors, in addition to the regular preoperative evaluation of PICC. The PICC operations in upper limbs should be made by seasoned operators as well as good doctor-nurse cooperation, closely monitoring patients during operation and careful postoperative nursing.

1. Introduction

Mediastinum tumors, being found in different locations of mediastinum, have show different clinical symptoms including paraneoplastic disorders, heterogeneous histologic types, and different behaviors ranging from indolent benign characteristics to highly malignant tumors. No generally accepted district partition of mediastinum until recently, tumor-node-metastasis (TNM) classification available for thymic epithelial tumors[1,2]. Moreover, no general diagnostic and therapeutic guidelines are available for mediastinal neoplasms, as most of these are rare tumors[3].

A dependable central venous access device is vital for treatment of cancer patients. Central venous access devices not only give conveniences to manage chemotherapeutic agents and antibiotics but also provide a route for blood transfusion. The vital factors, to choose the optimal central venous access device in cancer patients, are types of chemotherapy, the duration of the treatment and the ease of care of the catheter[4]. Compared with conventional central venous access devices, peripherally inserted central catheters (PICC) have the advantages of easier insertion and removal, further applied to cancer patients more and more[5,6].

The complications of PICC are venous thrombosis, blood infections and inflammation of puncture site, upper extremity venous thrombosis most common for PICC under upper limb[7]. A previously published study indicates that there was 5% of hospitalized patients developed symptomatic upper extremity venous thrombosis after PICC[8], the incidence of cancer patients higher than other patients. The incidence of upper extremity venous thrombosis in oncology patients has been reported to range from 0.3% to 28.3%; of 237 oncology patients who received PICCs, 36 (15%) were found to have symptomatic upper extremity venous thrombosis[9,10]. Probably the factors of the big differences in these rates are specific populations, uses of diagnostic methods, locations of the catheter tips, and others. Although most cases are asymptomatic as well as their clinical importance uncertain, it can produce a huge impact on the health of patients when upper extremity venous thrombosis happened, further leading to serious morbidity, including septic thrombophlebitis, postphlebitic
syndrome, and pulmonary embolism[11-13].

In this study, we establish a reliable venous access by PICC placement, in patients with mediastinum tumor, aiming to discuss the different operative programmes made through the size of mediastinum tumors, severity degree, clinical symptoms and colour duplex ultrasonography under blood vessel of upper limbs, in addition to common preoperative evaluation of PICC. We choose senior doctors to operate, ensure the cooperation good between doctors and nurses, and keep rigorous intraoperative monitor and careful postoperative nursing, in order to lengthen ductal indwelling time to alleviate the patients’ pain.

2. Materials and methods

2.1. Clinical materials

This study included 10 patients in PICC who managed at our department from January 2016 to December 2017. Inclusion criteria were as follows: 1) patients aged between 17 to 70 years old; 2) patients were diagnosed as mediastinal tumor confirmed by clinical symptoms and laboratory testing; 3) patients planned for chemotherapy by PICC; and 4) patients without chemotherapy and venous catheterization contraindications. We chose 10 patients accepted PICC placement for chemotherapy, sex ratio was 4:1, and the types of tumors were 6 cases of small-cell lung cancer, 2 cases of large cell lung cancer, 1 case of mediastinal seminoma and 1 case of thymoma. The clinical symptoms of 10 patients were shown as table 1.

<table>
<thead>
<tr>
<th>Symptoms</th>
<th>Tumor (10 cases)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chest congestion</td>
<td>3</td>
</tr>
<tr>
<td>Coughing</td>
<td>6</td>
</tr>
<tr>
<td>Anhelation</td>
<td>3</td>
</tr>
<tr>
<td>Dyspnea</td>
<td>2</td>
</tr>
<tr>
<td>Superior vena cava syndrome</td>
<td>2</td>
</tr>
</tbody>
</table>

2.2 Catheter insertion procedure

2.2.1 Comprehensive evaluation before PICC

The patients should be informed of their condition and successful cases of catheter, in order to alleviate their anxiety and boost their confidence. It’s necessary to make the PICC preoperative evaluation according to the size of mediastinum tumors, severity degree, clinical symptoms and colour duplex ultrasonography under blood vessel of upper limbs, except for common ones. There is superior vena cava syndrome (SVCS) in two cases, one of which associated with huge mediastinal tumor. The chest CT showed that there was a huge occupation lesion in the front mediastinum whose size was 12.8 cm ×8.2 cm×8.0 cm. Multi-disciplinary team was organized to discuss the two cases, consisting of oncologists, radiologists and nurses. The conclusion was that it’s vital to keep eyes on the condition of patients with PICC and extubate the catheter once SVCS worse.

2.2.2 Preparation of operators

There was SVCS in two cases, so the PICC catheter was difficult to operate[14]. To make sure the success of placement, the operators should be experienced. Intravenous infusion on upper limbs should be made tentatively at one day preoperation to test if there were edema in upper limbs and neck and make sure the symptoms of coughing and anhelation were not aggravated. The consultation was organized to make the plan and discuss the difficulties of cases, made up of doctors and surgery nurses. Firstly, operators can conduct patients to change their posture to search the location by ultrasound when the position of catheter tip is wrong. It’s good to shift their attentions by talking with patients. The solutions are giving oxygen and extubating catheters when SVCS worse during PICC.

2.2.3 PICC catheter

Peripherally inserted central catheters were inserted according to the manufacturer’s instruction. To avoid disability as much as possible, care was taken to choose the non-dominant hand. The basilic vein was identified with ultrasound guidance. The PICCs were introduced with the Seldinger technique with the arm abducted in a supine position. The catheter length was determined with a guide-wire marked in centimeters. During the whole procedure, the patient was under electrocardiographic supervision to identify any arrhythmias induced by catheter placement. The final position of the PICC tip was found in superior vena cava. After the procedure, the PICC tip position was documented in expiration with a chest x-ray in three different positions: with the arm abducted in supine position, the arm adducted in supine position, and the arm adducted in upright position[15].

2.2.4 Care of PICC

Dressing and needle-free connector were concomitantly changed once a week. The PICC insertion zone was kept visible, using transparent dressings. Twice a week, a 10 mL flushing of normal saline solution was performed to maintain PICC patency. Patients should eat the food which are high protein, high calorie and digestible. It’s better to make special meals and it’s important to keep the infusion speed and fluid replacement stable. To apply diuretic following the doctor’s advice will help alleviate the condition of humoral retention.

2.3 PICC related complications

2.3.1 Formation of venous thrombosis

Using prospective sonographic scans to screen venous thrombosis after the catheter was installed for 6 consecutive weeks regularly. Thrombosis was identified on the basis of 3 sonographic signs: (1) lack of normal vein compressibility; (2) lack of a color signal from the vessel on a color Doppler scan; and (3) lack of a signal from the vessel on a spectral Doppler scan[17]. We classified upper extremity venous thrombosis as “superficial” if it involved the cephalic, basilic, median antebrachial, median antecubital[18], and accessory cephalic veins and as “deep” if the thrombus extended into the axillary, subclavian, and internal jugular veins or was located
more centrally[19]. Low-molecular-weight heparin therapy was initiated once thrombosis was identified by Doppler sonography[20]. Therapeutic-dose anticoagulation was defined as 10 000 U of low-molecular-weight heparin subcutaneously once daily for at least 3 consecutive months.

### 2.3.2 Catheter–related infection

It is made up of bloodstream infection and inflammation of the exit site. Bloodstream infection defined by the presence of the same organism grow from at least 1 percutaneous blood culture and from a culture of the catheter tip, or that 2 blood samples be drawn that, when cultured, meet CRBSI criteria for quantitative blood cultures or differential time to positivity. Inflammation of the exit site: defined by an uncomplicated exit-site infection without systemic infection, positive blood culture, or purulence.

### 3. Results

There are 10 patients who accepted PICC catheter, including 4 cases of left upper limb and 6 cases of right upper limb. After operations, the chest X-ray showed that catheter tips were all in desirable locations between sixth and eighth bone landmark of sternum. The time of operation was 5.5–9.5 (7.59±0.91) min in an average. All patients were done with treatment successfully. Tube-retained time of 10 patients was 3–12 (7.58±1.00) months in an average. The fluid in the catheters was fluent and there were no infection, plugging, thrombosis and bleeding of the exit site.

### 4. Discussion

Mediastinum tumors, being found in different locations of mediastinum, has shown different clinical symptoms including paraneoplastic disorders, heterogeneous histologic types, and different behaviors ranging from indolent benign characteristics to highly malignant tumors. In this study, we we establish a reliable venous access by PICC placement, in patients with mediastinum tumor, aiming to provide convenience with chemotherapy. To make the PICC preoperative evaluation accroding to the size of mediastinum tumors, severity degree, clinical symptoms and colour duplex ultrasonography under blood vessel of upper limbs, except for common ones. To make sure the success of placement, the operators should be experienced. Peripherally inserted central catheters were inserted according to the manufacturer’s instruction. The basilic vein was identified with ultrasound guidance. During the whole procedure, the patient was under electrocardiographic supervision to identify any arrhythmias induced by catheter placement. After the procedure, the PICC tip position was tested with a chest x-ray to make sure the operation successful. We give a strict care after PICC catheter to avoid PICC related complications as well as ensuring nutrient intake. The results showed: there was nothing unusual after PICC catheter and the catheter tips were all in ideal locations by chest X-ray. All patients were done with treatment successfully and the fluid in the catheters was fluent and there were no infection, plugging, thrombosis and bleeding of the exit site.

### References


