Case report

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Secondary malposition of a PICC-port due to heavy physical exercise: A case report

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Abstract

Physical exercise is often encouraged in cancer patients, mainly for the purpose of rehabilitation and for its psychological benefit. Some authors also suggest that exercise—specially in patient with peripherally inserted central venous access devices—may contribute to reduce the risk of catheter-related thrombosis. Still, the impact of physical exercise on the risk of device-related complications is not yet defined.

We report a case of secondary migration of the tip of an arm port, caused by high-intensity exercise in a woman undergoing chemotherapy because of ovarian cancer. Tip migration was suspected because of malfunction (persistent withdrawal occlusion) and diagnosis established after ultrasound examination and chest x-ray.

Even if exercise may yield benefit in the cancer patient on chemotherapy, the risk of mechanical complication of the venous access device—such as tip migration—should be considered in the case of high-intensity exercise.

Keywords

Arm port, PICC-port, secondary malposition, ultrasound, venous thrombosis, plank exercises

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Introduction

Totally implantable venous access devices (ports) are widely used in cancer patients for chemotherapy. For years, the chest has been the most popular and reliable access site for port implantation. More recently, PICC-ports have been introduced as an alternative option to chest ports, because of their unique advantages in terms of low risk of complications and optimal psychological and cosmetic acceptance.[1,2] PICC-port insertion is overall a safe procedure, but it may be associated with late complications such as venous thrombosis, dislocation and infection.[1,3,4] Cancer patients with PICC or PICC-port may have a greater risk of venous thrombosis compared with the general population. Observational studies have identified risk factors for PICC-related thrombosis, such as higher age, overweight, some chemotherapy drugs (5-fluorouracil and oxaliplatin) and diabetes.[4–7] PICC-ports are often implanted in the dominant arm, and—after implantation—patients are usually invited to continue or start physical activities, moving their arms without limitations; this practice is supposed to be associated to a decreased risk of venous thrombosis. Though, exercise has also some benefits in terms of physical and psychological rehabilitation.

Very few studies have evaluated the effects of physical exercise in patients with an intravenous access for chemotherapy.[8–10] Handgrip exercises using an elastic ball have been associated with a reduction of incidence of catheter-related thrombosis in cancer patients.[8] The traditional Chinese discipline of Tai Chi, which implies soft, slow and coordinated movements of the limbs also is apparently associated with a 14% reduction of thrombosis.[9] The incidence of venous thrombosis may also be affected by time, frequency, intensity, and type of exercise. A recent study compared the incidence of PICC complications between

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Figure 1. X-ray: the whole catheter is kinked and rolled up inside the basilic vein.

high-intensity versus low-to moderate intensity exercise in patients on oncological treatment.[10] high-intensive exercise was associated with a higher risk of exercise-related adverse events, such as thrombosis, dislocations or other complications (arm swelling, occlusion/no back flow, leakage, pain at the exit site), compared to low-to moderate intensity exercise, although there were no statistically significant differences between groups.

We report the unusual case of tip migration of a PICC-port, apparently caused by intense physical activity. This case report has been approved by Ethic Committee of our hospital.

Case description

A 49-year-old woman suffering from ovarian/tubal cancer underwent hysterectomy and bilateral salpingectomy. Adjuvant antiblastic chemotherapy was planned, so that a PICC-port was inserted via the right basilic vein, in the procedure room of the outpatient facilities of our Oncologic Gynecology Unit.

Insertion was performed according to our hospital policies: preprocedural ultrasound assessment of the brachial and cervico-thoracic area,[11,12] skin antisepsis with 2% chlorhexidine in 70% isopropilic alcohol, maximum barrier precautions, ultrasound-guided local anesthesia and venipuncture, ultrasound-based tip navigation of the catheter, tip location using the intracavitary ECG method,[13] connection of the catheter with the reservoir, subcutaneous placement of the reservoir, control for correct function (withdrawal and infusion), closure of the pocket with intradermic absorbable sutures and cyanoacrylate glue. The device (MiniMax, Plan-1-Health: very-low-profile reservoir connected to a 5Fr polyurethane catheter) was implanted without any intra-procedural complication, and the patient was discharged with the indication to move her arms without restrictions and to continue her daily aerobic activity. The first session of chemotherapy was carried out uneventfully.

Three weeks later, as the patient came to our Unit for the second chemotherapy session, the nurses reported a persistent withdrawal occlusion (PWO). The Huber needle was appropriately placed inside the reservoir and there were no local signs suggesting mechanical or inflammatory complications. As no blood could be withdrawn from the device, chemotherapy was not administered, and the patient was immediately examined by our vascular team.

According to our current policy, as described in a previous paper,[14] a bedside transthoracic ultrasound "bubble test" was performed so to verify whether the catheter tip was still in the proper location, that is, in the proximity of the cavo-atrial junction. Using the sectorial transducer of a wireless probe (Cerbero, ATL) via the subcostal view, 10 ml of shaken saline solution were rapidly injected through the device, but no turbulence was evident in the right atrium. The injection was repeated with a saline-air mixture (9 ml:1 ml). Since again no bubbles appeared in the right atrium, a catheter malposition was suspected. The main veins of the right cervico-thorax area (axillary, subclavian, internal jugular, and brachiocephalic vein) were assessed by infra/supraclavicular ultrasound scan using the linear transducer of the Cerbero wireless probe, but the catheter was not visible anywhere. An ultrasound evaluation of the veins of the right arm excluded any sign of venous thrombosis, and the catheter was visualized inside the basilic vein, but associated to an unusual image of "double catheter." Injecting saline into the device, a "bubble" effect was visible locally, inside the basilic vein. At this point, catheter fracture[15] or disconnection[16] from the reservoir with fragment embolization was suspected, so that a chest X-ray was performed.

The chest X-ray showed no catheter fracture or embolization: the whole catheter was kinked and rolled up inside the basilic vein (Figure 1). Answering specific questions on the physical activity she had performed, the patient reported a recent intense aerobic activity, in particular, different types of "plank" exercises (Figure 2).

The device was removed in local anesthesia. At removal, the catheter was intact, still connected to the reservoir, and completely intravascular. The vein did not suffer any damage during the removal of the device and the local wound healed uneventfully.

Few days later, a PICC-port was inserted successfully in the other arm. The patient has abandoned the plank exercises and she is currently using the new PICC-port on her left arm for chemotherapy, without any complication.

Discussion

Before starting the antiblastic infusion through a venous access device, it is usually recommended to check the proper function of the catheter in terms of easy blood

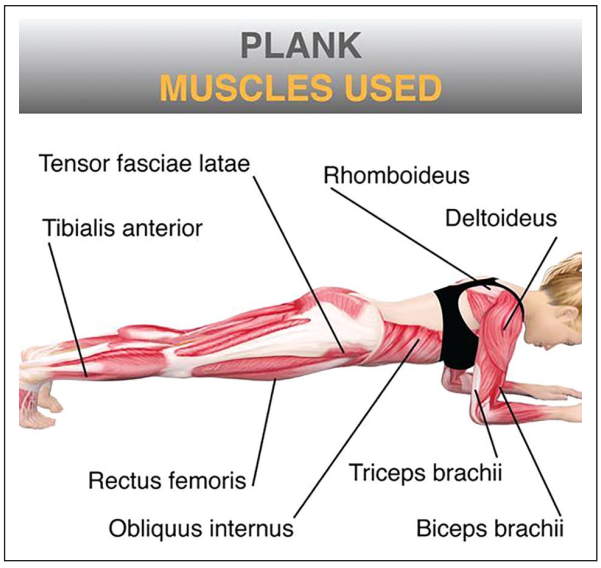

Figure 2. Muscles activated during prone plank exercises.

withdrawal and easy saline infusion. In case of PWO, the antiblastic infusion cannot be administered and the appropriate steps must be taken so to exclude an abnormal position of the catheter tip or other mechanical problems. When the device has been placed using an accurate intraprocedural method such as intracavitary ECG, a primary malposition can be excluded, so that the unexpected detection of PWO may be caused by a "tip migration," that is, a secondary malposition of the catheter tip.

Catheter tip migration has been described after prolonged increase of the thoracic pressure (vomiting, cough, sneezing etc.) but also after physical efforts (i.e. weight lifting). Usually, the tip is pushed inside the ipsilateral internal jugular vein or back to the ipsilateral subclavian vein.[17,18]

In our case report, tip migration was peculiar because the physical effort was so intense that the catheter rolled back completely inside the veins of the arm. Also, the nature of the physical effort (plank exercises) was quite unusual.

The plank (also called a front hold or abdominal bridge) is an isometric core strength exercise that involves maintaining a position like a push-up for the maximum possible time.

The traditional prone plank exercise involves raising the body onto the forearms and toes, lying face down with fists against the floor, feet apart, while spine, shoulder, pelvis, and head are kept in a neutral position, with the elbows apart.

Prone plank exercises activate several muscles: the internal oblique, the rectus abdominis, and the external oblique that, when activated together, increase the intra-abdominal pressure,[19] much more in suspended exercises compared to floor based plank exercises.[20]

Although to a lesser extent, plank exercises also activate the brachii biceps and triceps muscles, the deltoideus and rhomboideus muscles (Figure 2).

In our case, the secondary malposition was probably due to high intensity plank exercises, as the patient was unaware of the risks associated with such intense and heavy physical activity. The possible mechanisms that lead catheter migration during the exercise could be: (a) the rhythmic muscle contractions associated with an intra-abdominal pressure increase, (b) an intrathoracic pressure increase with an (c) increase in pressure on the horizontal portion of the catheter, that cause (4) a lateral migration of the catheter tip while the vertical force causes its upward migration. These effects cause the catheter tip to move upward from the cavo-atrial junction. This, in turn, leads to flattening of the curvature of the catheter and increases the length of the catheter exposed to the upward forces caused by increased intra-thoracic pressure. This portion of the catheter is more likely to move upward and deviate or kink and roll up inside the vein.

Conclusions

Secondary malposition of a PICC or a PICC-port is a rare complication. Tip migration is sometimes clinically suspected because of PWO. When PWO is detected, it is mandatory to check its cause before using the device. Our protocol is as follows:[14] (a) first, check tip location via a transthoracic echocardiography with "bubble test"; (b) then, perform an ultrasound assessment of the entire cervico-thoracic area trying to visualize the catheter; (c) last, if such maneuvers do not bring enough information, perform a chest X-ray.

In patients with PICC-ports (and probably also in patients with PICCs), heavy physical exercises should not be encouraged; although they can theoretically reduce the risk of venous thrombosis and have some benefits in terms of physical and psychological rehabilitation, they can be associated with secondary malposition and device malfunction.

Declaration of conflicting interests

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