Long-Term Central Venous Access

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The use of multidrug chemotherapy and bone marrow transplantation in cancer treatment has made the utilization of reliable, long-term venous access (LTVA) an essential component of cancer therapy. The placement of LTVA devices not only permits the delivery of these complex therapeutic regimens but also drastically improves patients’ quality of life.

Overview

Long-term central venous access (LTCVA) plays a critical role in the management of cancer patients. Such LTCVA devices are particularly important in providing a reliable venous route for successful administration of multidrug anticancer chemotherapy regimens and for various aspects of therapeutic and supportive care during bone marrow transplantation. Placement of LTCVA devices not only enables delivery of these complex therapeutic regimens, but it can also dramatically improve cancer patients’ quality of life.

Indications

No definitive guidelines exist in the cancer literature regarding selection of the most appropriate type of LTCVA device for management of individual cancer patients. Nevertheless, there are several important factors to consider when selecting an LTCVA device:

• Frequency and duration of therapy
• Frequency of blood draws
• Nature of the therapy (eg, delivering vesicating agents into a central vein decreases the risk of extravasation)
• Need for supportive therapies (eg, total parenteral nutrition or systemic antibiotics)
• Need for stem cell collection, plasmapheresis, and bone marrow reinfusion
• Patient preference

Patient Selection

LTCVA device placement should always be considered an elective procedure. Therefore, before an LTCVA device is placed, the patient should have recovered from any acute infections and the treatment of complications. If there is an absolute need for immediate central venous access (CVA), a temporary percutaneous CVA catheter can be placed. A history of vascular access catheter insertion, deep venous thrombosis of an upper extremity vein or central vein, thoracic surgery, neck surgery, irradiation, mediastinal and thoracic disease, or a history of congenital cardiac abnormalities should alert the surgeon to possible alterations or changes in the normal venous anatomy and venous drainage patterns. Always assess and correct the intravascular volume status of the patient (if possible) before attempting elective placement of an LTCVA device.

Physical Examination

Physical examination, documenting the integrity of the skin, changes in the skin secondary to previous surgical treatment and reconstruction, sites of previous central venous access catheter insertions, evidence of venous obstruction (presence of venous collaterals in the skin of the chest, unilateral arm swelling, or superior vena cava syndrome), and pulmonary reserve, should be performed in every patient. If, on clinical examination or by history, there is any suspicion or documented evidence of congenital, treatment-induced, or disease-induced alterations in venous anatomy, consideration should be given to obtaining pre-procedural formal venous imaging at a time prior to attempted LTCVA device placement. Such venous imaging studies include those described below.
Duplex Doppler Ultrasonography

Duplex Doppler ultrasonography can visualize the patency and flow of the neck and arm veins. Intrathoracic veins and the right atrium are not well visualized by standard transcutaneous duplex Doppler ultrasonography, but they can be better visualized with transesophageal echocardiography.

CT and MRI Venography

CT (computed tomography) and MRI (magnetic resonance imaging) venography are gaining more recognition as useful venous imaging modalities for documenting the presence of thrombosis and the patency of major intrathoracic veins.

Standard Contrast Venography

Standard contrast venography has been a long-time gold standard for studying venous anatomy. Standard contrast venography is useful not only for evaluation of the venous anatomy prior to attempted LTCVA device placement, but it can also be extremely useful at the time of attempted LTCVA device placement, if there is difficulty with passing/advancing the guidewire or the CVA catheter and when aberrant catheter position is suspected. Standard contrast venography performed at the time of attempted LTCVA device placement can allow for easy recognition of treatment-induced and disease-induced alterations of the thoracic central venous anatomy, as well as for easy recognition of congenital aberrancies of the thoracic central venous system, that could impact negatively upon the outcome of LTCVA device placement if otherwise unrecognized at the time of attempted placement.

Chest Radiography

Although it does not represent formal venous imaging, radiography of the chest (eg, chest x-ray) can reveal important information (eg, presence of pleural effusions, lung metastases, mediastinal adenopathy, mediastinal tumors) that can modify selection of a site for LTCVA device placement.

Contraindications and Precautions

Neutropenia

A neutrophil count < 1,000/µL is a relative contraindication to placement of an LTCVA device, given that patients with neutropenia may have a higher incidence of septic episodes. Use of prophylactic antibiotics may reduce the incidence of infection in patients with a low absolute neutrophil count.

Thrombocytopenia

Thrombocytopenia and platelet dysfunction are frequently encountered in the cancer patient. Although there are no universal consensus guidelines regarding platelet transfusion for thrombocytopenia patients planned for placement of an LTCVA device, perioperative platelet transfusion to approximately 50,000/µL may allow the central venous catheter to be safely placed with a reduction in the risk of bleeding complications. In patients with thrombocytopenia refractory to platelet transfusions, venous cutdown may be a safer approach for central venous catheter placement.

Clotting Factor Abnormalities

Many cancer patients have abnormalities in their clotting factors secondary to malnutrition or chemotherapy. Correction with vitamin K or fresh frozen plasma may be necessary.

Active Infection

The presence of an active infection represents an absolute contraindication to placement of an LTCVA device. In patients with an active infection who require long-term antibiotic treatment, a temporary percutaneous CVA catheter or a peripherally inserted central venous catheter is preferable.

LTCVA Device Selection

TABLE 1
Differences between percutaneous tunneled external catheters and subcutaneous implanted ports

Two types of LTCVA devices are available. There are percutaneous tunneled external catheters that are accessible above the skin surface (eg, Hickman, Broviac, Leonard, Groshong, Quinton). Likewise, there are subcutaneous implanted ports (eg, Port-A-Cath, Infusaport, Mediport). Both types of LTCVA devices are available with different lumen diameters and numbers of lumens. Peripherally placed central venous access devices, such as the PICC (peripherally inserted central catheter) line and the PAS (peripheral access system) port, have now become more commonplace because of their ease of placement.

Important differences between percutaneous tunneled external catheters and subcutaneous implanted ports are outlined in Table 1.

General Considerations

An important general consideration in the selection of an appropriate LTCVA device is that the infusion flow resistance depends on the catheter length and lumen diameter. Likewise, catheters with a split valve at the tip (Groshong catheter) are less reliable for blood drawing.

Frequency of Device Access

Subcutaneous implanted ports are preferred in patients who require intermittent device access for treatment or blood drawing. Percutaneous tunneled external catheters are preferred in patients who require continuous or frequent device access for treatment, blood drawing, or delivery of supportive therapies (eg, intravenous fluid hydration, parenteral nutrition, blood product transfusion, pain medication) or who are receiving therapy that would be potentially toxic if extravasated into the subcutaneous tissues. Additionally, peripherally placed central venous access devices can be useful in patients who require single, continuous, infusional therapy (eg, systemic antibiotics, intravenous fluid hydration, pain medication), as is seen frequently in cancer palliative care.

Number of Lumens

The choice of the number of lumens should be based on the intensity and complexity of the therapy.

Specially Designed Catheters

There are specially designed catheters for hemodialysis or apheresis treatment. These catheters are shorter and have a lumen that is larger in diameter and is staggered at the tip of the catheter to prevent recirculation. These catheters have a higher incidence of kinking, so care should be taken to avoid sharp angles at the skin exit site. In patients who already have an LTCVA device in place and require short-term access for apheresis or stem cell collection, consideration should be given to placing a temporary percutaneous hemodialysis or apheresis catheter on the contralateral side, rather than replacing the existing LTCVA device.

Methods of Insertion of LTCVA Devices

Placement of LTCVA devices (eg, percutaneous tunneled external catheters, subcutaneous implanted ports, and PAS ports) is generally best performed under sterile conditions in a surgical suite or an interventional radiology suite, to minimize the incidence of infections. These procedures are generally performed using a local anesthetic in conjunction with an intravenous short-acting opiate analgesic (eg, fentanyl) and a benzodiazepine sedative (eg, midazolam), thus safely providing a
satisfactory level of patient comfort and sedation throughout the procedure. The use of periprocedural fluoroscopy during LTCVA device placement is strongly recommended: (1) to allow the operator to observe the course of the guidewire and catheter as they pass down through the thorax region under fluoroscopy, as this enables identification of any aberrancies in the catheter pathway suggesting congenital, treatment-induced, or disease-induced alterations in venous anatomy; (2) to help select final catheter tip location; and (3) to help prevent potential procedural complications. PICC lines can be placed by specially trained nurses under sterile conditions on the hospital wards or in dedicated procedure rooms.

The most common technique used in LTCVA device placement is the percutaneous method of Seldinger; this involves the use of a venipuncture needle, guidewire, and dilator and peel-away introducer sheath, which are generally directed to the subclavian vein or the internal jugular vein. Periprocedural venous ultrasound, performed at the time of LTCVA device placement, is extremely useful for guiding successful placement of the venipuncture needle into the initial point of entry of the subclavian vein or the internal jugular vein, and has quickly become a standard of practice among healthcare providers involved in LTCVA device placement. Alternatively, a direct venous cutdown approach to the cephalic, external jugular, internal jugular, or saphenous vein can provide appropriate access for LTCVA device placement. The direct venous cutdown approach, which does not require the use of a venipuncture needle, guidewire, or dilator and peel-away introducer sheath, for LTCVA device placement, essentially eliminates the risk of significant periprocedural complications, such as pneumothorax or injury to a major vascular structure.

A postprocedural upright chest x-ray is highly recommended after LTCVA device placement to document successful central venous catheter placement, to document catheter tip location, and to help recognize any potential periprocedural complications.

Device Care

Subcutaneous Implanted Ports

Subcutaneous implanted ports require minimal to no care when they are not accessed. Subcutaneous implanted ports should be flushed after each use with heparin solution (3-5 mL; 100 U/mL), as well as monthly during periods of nonuse. Nevertheless, there are no prospective randomized data supporting the need for monthly flushing vs longer durations of time between flushing during periods of nonuse for subcutaneous implanted ports. During continuous infusion therapy via a subcutaneous implanted port, the percutaneous noncoring (Huber) access needle should be replaced every third to fifth day, using sterile technique, and an occlusive dressing should be reapplied. However, continuous use of subcutaneous implanted ports for a duration of greater than 3 to 5 days generally should be discouraged, as subcutaneous implanted ports are intended for individuals who require only intermittent device access. Instead, an intervening interval of de-access of the subcutaneous implanted port should be considered prior to re-access of the subcutaneous implanted port, in order to minimize the risk of infectious complications.

Percutaneous Tunneled External Catheters

Percutaneous tunneled external catheters require more frequent care. In general, it is recommended that Hickman-type catheters (eg, open-ended, non-valved design) be flushed after each use with a heparin solution (3–5 mL; 100 U/mL), and biweekly to weekly during periods of nonuse. It is generally recommended that Groshong-type catheters (eg, longitudinal slit, valved catheter design) be flushed after each use with normal saline solution (5–10 mL), and biweekly to weekly during periods of nonuse. The protective caps on the exterior hubs of all percutaneous tunneled external catheters can be replaced biweekly to weekly. In addition, the skin exit site around all percutaneous tunneled external catheters should be cleansed with an antiseptic agent biweekly to weekly, and an occlusive dressing should be reapplied.

Complications

During LTCVA Device Insertion

Complications during LTCVA device placement are generally related to the method of insertion and the experience of the operator.

Pneumothorax
Pneumothorax is the most common complication of the percutaneous insertion technique, especially via the subclavian vein approach. The incidence of pneumothorax has been reported in most series to be approximately 1% to 5%. It appears to be seen more frequently in nutritionally compromised and emaciated patients. Its incidence has also been thought to be related to the number of attempts required to access the vein and to the experience of the operator. Use of periprocedural venous ultrasound at the time of LTCVA device placement to guide placement of the venipuncture needle into the initial point of entry of the subclavian vein or the internal jugular vein during the percutaneous venipuncture approach will significantly reduce or eliminate the risk of pneumothorax. Likewise, use of a direct venous cutdown approach at the time of LTCVA device placement will essentially eliminate the risk of pneumothorax.

Pneumothorax is usually recognized on a post-procedural upright chest x-ray. The ability to detect a small pneumothorax on a chest x-ray can be aided by performing an expiratory film. Delayed pneumothorax can develop several hours to several days after an attempted percutaneous venipuncture approach to LTCVA device placement. If the pneumothorax is small (< 5%), the patient can be followed with subsequent chest x-rays, and the air occupying the pneumothorax can be left in place to be physiologically reabsorbed. Use of 100% oxygen can aid in reabsorption of a pneumothorax. Patients with a larger pneumothorax are generally treated by placement of a chest tube that is connected to a closed suction system or a Heimlich valve (one-way valve).

Iatrogenic arterial puncture

Iatrogenic arterial puncture occurs most frequently with the percutaneous internal jugular vein approach and less frequently with the percutaneous subclavian vein approach. Pulsatile flow confirms an arterial puncture. In this instance, the venipuncture needle should be removed and the vessel compressed for 5 to 10 minutes. If an arterial puncture is initially unrecognized and the guidewire is passed into the vessel, a position of the guidewire to the left of the thoracic spine on fluoroscopy should alert the operator to the suspicion of the occurrence of this complication. In a patient with a persistent left superior vena cava, the guidewire will also be seen to the left of the thoracic spine on fluoroscopy. Standard contrast venography performed at the time of attempted LTCVA device placement can be very helpful to confirm this diagnosis. Use of periprocedural venous ultrasound at the time of LTCVA device placement, to guide placement of the venipuncture needle into the initial point of entry of the subclavian or internal jugular vein during the percutaneous venipuncture approach, will significantly reduce the risk of iatrogenic arterial puncture.

Hemothorax as a result of injury to major vessels

Hemothorax as a result of injury to major vessels is seen less than 1% of the time, but when it occurs it can be life-threatening. During the percutaneous venipuncture approach, inadvertent injury to one of the major vessels secondary to improper operator technique with the venipuncture needle, guidewire, or dilator and peel-away introducer sheath may result in a hemothorax. Careful attention to insertion technique, the use of fluoroscopy, and the selective use of standard contrast venography can all help to prevent this complication. Use of a direct venous cutdown approach at the time of LTCVA device placement, which does not involve the venipuncture needle, guidewire, or dilator and peel-away introducer sheath, is much less likely to injure a major vessel than is a percutaneous venipuncture approach.

Most patients who develop a hemothorax can be treated with a large-bore, laterally placed chest tube connected to a closed suction system. Many of these closed suction systems have a blood reinfusion collecting system. Thoracotomy may be indicated in certain circumstances (in patients with ongoing bleeding [> 500 mL/hour] or with a massive hemothorax [> 1,500 mL]).

Local subcutaneous hematomas

Local subcutaneous hematomas can occur more frequently in thrombocytopenic patients or coagulopathic patients. They are best treated by local compression over the area of the subcutaneous hematoma. Adequate replacement of platelets and clotting factors prior to LTCVA device placement can help to prevent these complications.

Catheter tip malposition

Catheter tip malposition is usually recognized and corrected at the time of catheter placement by the use of periprocedural fluoroscopy. With the use of fluoroscopy, however, catheters situated in the azygos vein or the right internal mammary vein can look strikingly similar to catheters situated in the superior vena cava in an anterior-posterior projection. Frequently, these catheters do not withdraw blood easily and the catheter tip does not move with the cardiac rhythm. Lateral rotation of
the fluoroscope and utilization of standard contrast venography during LTCVA catheter placement can help to identify this sometimes subtle finding.

**Other Device-Related Complications**

**Catheter compression, fracture, and embolization**

Catheter compression, fracture, and embolization can occur when a central venous catheter placed by the percutaneous subclavian vein approach is inserted too medially along the clavicle at the medial costooclavicular ligament. In such cases, the catheter may become chronically compressed between the clavicle and the first rib. This can be recognized radiographically as a “pinch-off sign.” Chronic compression of the catheter may result in structural fatigue of the catheter wall that may eventually cause fracturing and distal embolization of the central venous catheter. This can be prevented by ensuring that the percutaneous venipuncture site is selected more laterally on the clavicle, as well as 1 cm to 2 cm below the clavicle. If this problem is recognized during central venous catheter placement, the catheter should be removed and then replaced through a different percutaneous venipuncture site.

**Device malfunction**

Device malfunction can be divided into two types: (1) inability to withdraw blood from a LTCVA device; and (2) inability to infuse into a LTCVA device. Inability to withdraw blood from a device, despite retaining the ability to infuse into the device, is most frequently caused by a fibrin sheath at the tip of the catheter that produces a one-way valve effect. Less frequently, it is due to a catheter tip being positioned against the side wall of the venous structure within which it resides. In patients with this problem, a Valsalva maneuver or repositioning of the patient (e.g., lying supine vs lying lateral decubitus vs sitting upright) can sometimes result in successful blood withdrawal. Inability both to withdraw blood from and to infuse into a LTCVA device can have many mechanical causes, such as catheter tip malposition, catheter kinking, catheter lumen thrombosis, intraluminal precipitation of medications, or venous thrombosis. A chest x-ray may identify some of these mechanical causes. Standard contrast venography, venous duplex Doppler ultrasonography, and CT and MR venography can all potentially be useful for evaluating a patient with this problem.

In 2013, the “Key Recommendations” provided in the American Society of Clinical Oncology (ASCO) clinical practice guidelines for central venous catheter (CVC) care stated, “Tissue plasminogen activator (t-PA) is recommended to restore patency in a nonfunctioning CVC; CVC removal is recommended when the catheter is no longer needed, if there is a radiologically confirmed thrombosis that does not respond to anticoagulation therapy, or if fibrinolytic or anticoagulation therapy is contraindicated.” Thrombolytic therapy, using tissue plasminogen activator (tPA) or alteplase (recombinant tPA), can help to restore the ability to withdraw blood from a device or to clear a device from intraluminal thrombosis or intraluminal precipitation of medications. Usually, 1 mg to 2 mg of tPA in 1 mL to 2 mL of sterile water is instilled into the device, left in place for 1 to 2 hours, and then aspirated. Alternatively, 2.5 mL aliquots (diluted to 1 mg/mL) of alteplase can be used in a similar fashion. This may be repeated daily for several days until total patency is restored. Likewise, chemical occlusion of a device resulting from precipitation of chemotherapeutic agents, poorly soluble salts (calcium, magnesium, or phosphates), or antibiotics (amikacin [Amikin], vancomycin) can be successfully treated with instillation of 0.2 mL to 1 mL of 0.1 N hydrochloric acid. The solution is irrigated in and out of the device for 2 minutes, left in place for 1 hour, and then aspirated. This may be repeated daily for several days until total patency is restored. Hydrochloric acid at these doses has not been associated with side effects or metabolic acidosis.

**External catheter damage**

The external portion of a percutaneous tunneled external catheter can be damaged at the site of an attached plastic clamp or at a suture site. Use of needleless connections for infusions and irrigations should prevent needle damage to external portions of the catheter. The external portion of a percutaneous tunneled external catheter should never be grasped and occluded with a surgical hemostatic clamp. Most external catheters have repair kits to replace any damaged external portion of the catheter.

**Drug extravasation**

Drug extravasation into the subcutaneous tissues can occur with subcutaneous implanted ports when there is inappropriate placement or accidental dislodgment of the percutaneous noncoring
(Huber) access needle from the reservoir of the subcutaneous implanted port. This may result in chemical cellulitis, tissue necrosis, and loss of soft tissues in the area of extravasation. Clinical signs of extravasation include pain, burning, soft-tissue swelling, skin erythema, and skin vesicle formation at the infusion site. If drug extravasation is suspected, the infusion should be stopped and the percutaneous noncoring (Huber) access needle should be immediately withdrawn and removed from the subcutaneous implanted port. Management depends on the type of drug infused, the amount of drug extravasated, and the degree/severity of resultant skin/tissue damage.

**Venous thrombosis**

Venous thrombosis secondary to CVA catheter placement occurs more commonly than is thought, since venous thrombosis may be present without the occurrence of any visible signs or symptoms (especially in those instances in which the evidence of venous thrombosis is nonocclusive). The incidence of venous thrombosis varies across multiple studies, ranging from 0% to 65%. Several risk factors have been identified for the development of central venous catheter-associated thrombosis. The incidence of venous thrombosis is higher in patients in whom the catheter tip is placed less centrally (e.g., in the innominate vein or proximal superior vena cava), as compared with more central placement within the distal superior vena cava/right atrial junction. Ideally, the catheter tip should be positioned at the superior vena cava/right atrial junction and should be free-floating. The incidence of venous thrombosis is higher in patients with multiple-lumen catheters than in those with single-lumen catheters. Venous thrombosis also occurs at a higher incidence when the device is placed percutaneously rather than via a venous cutdown approach. Peripherally placed central venous access devices have been shown to be associated with a significant risk of upper-extremity deep vein thrombosis. Preexisting hypercoagulable states predispose patients to development of venous thrombosis. A history of having multiple prior central venous access devices placed and a documented history of previous upper-extremity deep vein thrombosis and/or previous intrathoracic central venous thrombosis are additional risk factors for development of future central venous catheter-associated thrombosis.

Early retrospective studies have suggested that antithrombotic prophylaxis reduces the risk of central venous catheter-associated thrombosis in cancer patients. However, three more recent double-blind, placebo-controlled, randomized clinical trials (Verso et al 2005, Couban et al 2005, Karthaus et al 2006) assessing antithrombotic prophylaxis have subsequently failed to show any such risk reduction within the time frame of those studies.

In 2005, Verso et al evaluated enoxaparin, a low molecular weight heparin (LMWH) agent. Patients undergoing central venous catheter placement received either 6 weeks of a 60 mg daily dose of subcutaneous enoxaparin or 6 weeks of a daily subcutaneous placebo, and with the first dose administered 2 hours before catheter placement. The incidence of central venous catheter-associated thrombosis was assessed with venography at the time of suspected catheter-related complications or at completion of the study medication. The incidence of venography-proven thrombosis was not significantly different in the two groups, with 14.2% (22/155) in the enoxaparin group and 18.1% (28/155) in the placebo group. Symptomatic thrombosis was observed in 1% of the enoxaparin group and in 3.1% of the placebo group.

In 2005, Couban et al evaluated low-dose warfarin. Patients undergoing central venous catheter placement received either 9 weeks of a 1-mg daily oral dose of warfarin or 9 weeks of a daily oral placebo, and starting within 4 days after catheter placement. The incidence of central venous catheter-associated thrombosis was assessed clinically, as defined as symptomatic central venous catheter-associated thrombosis. All symptomatic cases were then confirmed radiographically, first by compression ultrasonography, and then by venography, if ultrasonography results were normal. There was no statistically significant difference in the incidence of symptomatic central venous catheter-associated thrombosis between the two groups, with a 4.6% (6/130) incidence in the low-dose warfarin group and a 4% (5/125) incidence in the placebo group.

In 2006, Karthaus et al evaluated dalteparin, another LMWH agent. Patients undergoing central venous catheter placement received either 16 weeks of a 5,000 IU daily dose of subcutaneous dalteparin or 16 weeks of a daily subcutaneous placebo, randomized in a 2:1 ratio of dalteparin to placebo, and starting within 5 to 7 days of catheter placement. The incidence of central venous catheter-associated thrombosis was assessed with venography or ultrasound at the time of suspected catheter-related complications or at completion of treatment with the study medication. There was no statistically significant difference in the incidence of symptomatic central venous catheter-associated thrombosis between the two groups, with a 3.7% (11/294) incidence in the dalteparin group and a 3.4% (5/145) incidence in the placebo group.
In 2009, De Cicco et al evaluated the oral anticoagulant agent acenocumarine vs the subcutaneous LWMH agent dalteparin vs no anticoagulant treatment in a non-blind, placebo-controlled, randomized clinical trial in patients undergoing LTCVA device placement. Patients undergoing LTCVA device placement received either acenocumarine (1 mg oral daily dose for 3 days before and then for 8 days after central venous catheter placement), or dalteparin (5,000 IU sc daily dose at 2 hours before and then for 8 days after central venous catheter placement), or no anticoagulant treatment. All patients were assessed for central venous catheter–associated thrombosis by venography performed on days 8 and 30 after central venous catheter placement or at the time of suspected catheter-related complications. The incidence of nonocclusive, occlusive, and overall total cases of central venous catheter–associated thrombosis in the three study groups was assessed on day 8 and day 30 after LTCVA device placement. Both acenocumarine and dalteparin significantly reduced the incidence of both the overall total cases of central venous catheter–associated thrombosis (acenocumarine, 24/114 [21.1%] at 8 days and 25/114 [21.9%] at 30 days; dalteparin, 46/120 [38.3%] at 8 days and 48/120 [40%] at 30 days; no anticoagulation, 60/114 [52.6%] at 8 days and 30 days) and the cases of nonocclusive central venous catheter–associated thrombosis (acenocumarine, 23/114 [20.2%] at 8 days and 24/114 [21.1%] at 30 days; dalteparin, 43/120 [35.8%] at 8 days and 44/120 [36.7%] at 30 days; no anticoagulation, 60/114 [52.6%] at 8 days and 58/114 [50.9%] at 30 days), as compared with patients who did not receive anticoagulant treatment. In this regard, acenocumarine was significantly more effective than dalteparin. However, specifically regarding cases of occlusive central venous catheter–associated thrombosis, there were no significant differences observed between the three study groups (acenocumarine, 1/114 [0.9%] at 8 days and 30 days; dalteparin, 3/120 [2.5%] at 8 days and 4/120 [3.3%] at 30 days; no anticoagulation, 0/114 [0%] at 8 days and 2/114 [1.89%] at 30 days). They concluded that antithrombotic prophylaxis may be considered for selected cancer patients with risk factors for development of central venous catheter–associated thrombosis.

As a last point with regard to low-dose warfarin antithrombotic prophylaxis in cancer patients with central venous catheters, data have also shown a high incidence of INR (international normalized ratio) abnormalities in patients receiving fluorouracil (5-FU)-based chemotherapy regimens who were maintained on 1 mg/day of warfarin, as noted in 55 of 427 patients (12.8%) reported by Magagnoli et al in 2005. In this regard, the authors recommended that such cancer patients should undergo periodic monitoring of the prothrombin time and INR if they are maintained on low-dose warfarin antithrombotic prophylaxis.

In 2013, as a consensus statement, the ASCO clinical practice guidelines on central venous catheter (CVC) care for the patient with cancer stated: “Prophylactic warfarin and low-molecular-weight heparin have not been shown to decrease CVC-related thrombosis, so routine use is not recommended.”

Treatment of documented venous thrombosis secondary to placement of CVA catheters should be directed toward prevention of pulmonary embolism, avoidance of clot propagation, prevention of the postphlebitic syndrome, and preservation of the LTCVA device, if possible. With these objectives in mind, the LTCVA device should be removed only if it is no longer necessary or if initial therapy for venous thrombosis fails and the patient’s symptoms progress. The patient can be treated initially with systemic heparinization or subcutaneous LMWH, and this can be followed by conversion to oral anticoagulation with warfarin or continuation with subcutaneous LMWH. The LTCVA device may be kept in place as long as the patient with previous symptomatic central venous catheter–associated thrombosis stabilizes and improves, and if there are no contraindications to anticoagulation therapy. According to NCCN guidelines for venous thromboembolic disease: (1) when the decision is made to keep the CVA device in place, anticoagulant therapy should be continued for a minimal duration of at least 3 months or for the duration of the life of the CVA device; and (2) when the decision is made to remove the CVA device, anticoagulant therapy should be continued for a minimal duration of at least 3 months after device removal.

Device-Related Infections

Please see the section “Catheter-associated infections” in the “Infectious complications” chapter.

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